Program Abstracts

Pre-Conference Primers, Saturday, 9:00 a.m. – 12:00 p.m.

What is Crime Mapping? A GIS Primer

What is Crime Mapping: A GIS Primer, **Kurt Smith.** This workshop is designed for participants who want to learn the basics of crime mapping. No prior knowledge is required, and explanations and activities will be very practical. By the end of the session, participants will be able to:

- ? Explain the term "crime mapping"
- ? Understand and apply the basic concepts and components of geographic information systems (GIS)
- ? Discuss and realize the importance of the data process and dissemination for GIS
- ? Identify free software and geographic data sources to jump-start crime mapping and analysis efforts within local jurisdictions
- ? Understand how to use mapping in their agency to support patrol, investigations, administration, crime prevention, courts/corrections, and the community
- ? Describe technological innovations on the horizon, using GIS

Data Scrubbing

Data Scrubbing: Tools and Techniques, **Christopher S. Gebhardt.** In this session, users will learn various tools and techniques for improving their geocoding success rates, also known as "hits." Different strategies will be examined and displayed including geofiles, geocoding, and dynamic address matching. Common techniques to improve the overall collection of address information will be discussed. There will be in-depth discussions regarding how to set up and use alias tables for both MapInfo and ArcView. Instructors will discuss what works in a GIS and what needs to be broken out to other database applications such as Microsoft Access. The importance of geocoding 100 percent of all records will be stressed with examples. The presentation will conclude with assorted problems the speaker has noticed and overcome, including vacant lots, fields, highways, and the use of GPS.

Introductions to Spatial Techniques and Analyses with GIS

Spatial Techniques for Analyzing Crime Data, **Deborah Thomas.** As the use of GIS expands throughout law enforcement agencies more and more maps of varying quality are created. Making crime maps has become fairly easy, and with this ease comes new insights into the geographic patterns of crime. Unfortunately, maps created without regard to the many caveats involved with GIS can also result in misinterpretation, perhaps even conveying incorrect information. In other words, interest in GIS and/or using it does not always equate to adequate knowledge about how the technology can enhance crime prevention. This session provides an overview of basic/intermediate GIS concepts and how they apply to crime mapping, concentrating on how GIS is used to solve real-world geographic problems. The focus will be on evaluation of different approaches used for the spatial analysis of crime data within a GIS context.

Mapping for Managers

***Mapping for Managers,* Jim Bueermann and Tom Casady.** This workshop is designed for those who manage police agencies and supervisors of operational or support units. This goal of the workshop is to introduce managers to the variety of ways geographic information systems can be used in policing and provide guidance on implementing GIS applications. The workshop will demonstrate the use of GIS for crime analysis, public information, strategic and tactical decision-making, and community policing. Participants will learn how two police chiefs have implemented GIS in their departments with novel twists — including deploying crime maps on the Internet and using GIS to assess community risk factors. Practical examples of actual GIS applications and results will be included.

Getting Started with MapInfo: A Hands-on Workshop – Part I

***Getting Started with MapInfo,* Alisa V. Anthony, William Boesch, and Noah Fritz.** This MapInfo interactive crime mapping workshop offers hands-on lesson using tactical crime analysis mapping techniques as well as a lesson using strategic crime analysis techniques for problem solving. This is a "bring-your-own-laptop" session. Participants will need to bring to class, at minimum, a Pentium II-200 mhz, 64 mb RAM laptop. Participants must also have MapInfo 5.5 (or better) installed on the laptop. This all-day session begins with the strategic analysis portion in the morning and continues in the afternoon with tactical analysis.

Getting Started with ArcView: A Hands-on Workshop – Part I

***Getting Started with ArcView,* Sean Bair, Danelle DiGiosio, and Steven Hick.** This ArcView interactive crime mapping workshop offers a hands-on lesson using tactical crime analysis mapping techniques as well as a lesson in using strategic crime analysis techniques for problem solving. This is a "bring-your-own-laptop" session. Participants will need to bring to class, at minimum, a Pentium II-200 mhz, 64 mb RAM laptop. They must also have ArcView 3.2 installed on the laptop. This all-day session begins with the tactical analysis portion in the morning and continues in the afternoon with strategic analysis.

Pre-Conference Primers, Saturday, 1:30 p.m. – 4:30 p.m.

Implementing GIS into a Law Enforcement Agency

***Implementing GIS into a Law Enforcement Agency,* Monica A. Nguyen and Matthew White.** This workshop is for crime analysts, criminal justice managers, and information technology personnel who have a basic understanding of GIS and information systems. Strategic planning, needs assessments, and implementation issues related to GIS will be among the primary areas of focus. Topics will include data management, integration issues, "selling" GIS, system acquisition, common obstacles, sources of assistance, and examples of what agencies are doing.

Hot Spot Methods

***Hot Spot Methods,* James Cameron and Spencer Chainey.** In the case of hot spot analyses of crime, a central concern is assessing the degree of spatial randomness observed in the data. Most of the available software tools provide different ways of determining whether the underlying pattern is uniform over space or whether there are significant clusters or other spatial patterns, which are not compatible with spatial randomness. Thus, simple mapping techniques can now be supplemented

with new methods and applications to detect meaningful patterns and associations as either part of an inductive approach to visualizing and exploring data or as a deductive approach to model building and hypothesis testing.

This workshop focuses on several tools which can be used to identify crime hot spots. These include: (1) ArcView choropleth mapping; (2) ArcView Spatial Analyst; (3) CrimeStat; and (4) SpaceStat. Each of these packages has particular strengths and weaknesses as well as different types of applications. The purpose of this workshop is to provide an overview of these applications, as well as a discussion of the advantages and disadvantages encountered in using these tools for different purposes.

Quantitative Crime Analysis

***Advanced Quantitative Crime Analysis with GIS*, Philip R. Canter.** Crime analysts have long recognized the value of using maps to assist in the identification of a crime problem. Maps can communicate information very effectively, enabling the detection of spatial relationships and crime patterns. Geographic Information Systems (GIS) resulted in even greater efficiency by enabling users to quickly query and display geographic information. Descriptive mapping, particularly in combination with different layers of geographic information, demonstrated the complex spatial relationships existing among types of crime. The ability of a GIS to display and relate geographic information has established a link between mapping and quantitative analysis. Interpretation of a spatial relationship can now be confirmed in an objective manner. This seminar will provide an overview of spatial crime analysis theory and methods using statistical and computer mapping programs. Participants will be introduced to a variety of computer programs available for the spatial analysis of crime. The seminar objective is to help users better understand the patterns, relationships, and trends in crime through the use of quantitative crime analysis and Geographic Information Systems.

Privacy, Confidentiality, and Data Display

***Privacy, Confidentiality, and Data Display,* Julie Wartell.** This workshop will cover the many issues surrounding crime mapping and privacy. The group will discuss the broad concept of providing maps and data outside an agency as well as specific issues regarding crime mapping on the Internet, sharing data across agencies, and sharing data with researchers. The workshop will look at what is currently being done and provide guidance on ways to share crime data and maps. Participants will leave this session with a greater understanding of this controversial issue as well as some tips for the decisionmakers in an agency on how best to implement crime mapping on the Internet. The workshop will be very interactive, and participants will have the opportunity to share their views and experiences.

Getting Started with MapInfo: A Hands-on Workshop – Part II

***Getting Started with MapInfo,* Alisa V. Anthony, William Boesch, and Noah Fritz.** This MapInfo interactive crime mapping workshop offers hands-on lesson using tactical crime analysis mapping techniques as well as a lesson using strategic crime analysis techniques for problem solving. This is a "bring-your-own-laptop" session. Participants will need to bring to class, at minimum, a Pentium II-200 mhz, 64 mb RAM laptop. Participants must also have MapInfo 5.5 (or better) installed on the laptop. This all-day session begins with the strategic analysis portion in the morning and continues in the afternoon with tactical analysis.

Getting Started with ArcView: A Hands-on Workshop – Part II

***Getting Started with ArcView,* Sean Bair, Danelle DiGiosio, and Steven Hick.** This ArcView interactive crime mapping workshop offers a hands-on lesson using tactical crime analysis mapping techniques as well as a lesson in using strategic crime analysis techniques for problem solving. This is a "bring-your-own-laptop" session. Participants will need to bring to class, at minimum, a Pentium II-200 mhz, 64 mb RAM laptop. They must also have ArcView 3.2 installed on the laptop. This all-day session begins with the tactical analysis portion in the morning and continues in the afternoon with strategic analysis.

Opening Session, Sunday, 1:30 p.m. – 2:45 p.m.

GIS and the Broken Windows Hypothesis

***Approaches to Crime Predictive Modeling: Broken Windows, Leading Indicators, and More,* Wilpen L. Gorr.** Major purposes of research on crime predictive modeling include theory testing (Is there support for the broken windows hypothesis?) and assessing predictive accuracy of models (Do leading indicators such as soft crimes improve the forecast accuracy of hard crimes?). Both are important. This talk, however, concerns primarily the latter, predictive accuracy. The presenter will review the range of predictive models, from naïve to complex, appropriate for police applications. Included will be so-called naïve methods, extrapolative methods, leading indicator models, and other models. Also, the talk will address unique features of crime predictive modeling including problems caused by small-scale data (e.g., there are relatively few monthly robberies per car beat or census tract), the benefits of having space and time series data, and the potential for a partnership of crime mapping with crime predictive modeling.

***Public Order Crime and More Serious Offending: What Does Crime Mapping Indicate about the Link?* William R. Kelly.** In recent years, considerable academic, programmatic, and policy attention has been given to a rising concern about public order offending and the potential for it to undermine communities. Derived from research on the "incivilities thesis" and its variants, the idea is that so-called "petty" offenses (e.g., panhandling, public intoxication, vandalism), if left unaddressed, undermine community residents' feelings of safety and the business community's assessments of economic vitality and opportunity. In turn, social disorder and decreased economic activity ensue, contributing to a cycle that ultimately results in increased misdemeanor, serious criminal offending, and deterioration of social order. It is the hypothesized link between less serious crime and more serious crime that is the subject of this research.

Empirical work on the link between disorder and crime remains limited. In particular, in examining intra-city variation in disorder and crime, researchers have largely ignored the manner in which they are distributed in space. Incorporating spatial information into the analysis can lead to important insights concerning the nature of the process linking disorder and less serious offending to more serious crime.

This study extends work in this area using a database and a spatial-analytic methodology which allows us to address a range of questions concerning the spatial and temporal relationships between public order offending and different types of serious crime. The data come from the Austin Police Department, and include multiple waves of selected public order and more serious crimes (offense, location, time/date) in the City of Austin over the time period 1992 to 2000. In the first part of the analysis, spatial factor analysis is used in an effort to reduce the dimensionality of the database by aggregating those types of serious criminal events which cluster together in space to form crime indices. This method is also applied to public order offending. In the second part of the analysis, a two-stage modeling strategy begins by fitting a series (by offense type) of generalized linear mixed models to the

data in order to provide separate estimates of change across a six-year time span for sub areas of the city. In the second stage of the analysis, spatial regression techniques model the intra-city variation of these estimates and allow consideration of the spatial structure of the data. These models will allow us to determine the extent to which changes in the rates of public order crime are linked to changes in the rates of more serious crime. In the final stage of the analysis, similar models examine spatial heterogeneity in temporally lagged effects of public order crime on various types of more serious crimes. The research also examines the extent to which the impact of public order offending may be moderated by socio-demographic context.

Concurrent Breakouts, Sunday, 3:15 p.m. – 4:45 p.m.

Federal Data Resources

***Federal Data Resources,* William Ballweber.** Among justice information and services from NCJRS, this presentation will cover a new online "E-Biz" ordering service for NCJRS publications, as well as a review of the online Calendar of Events and the online NCJRS Abstracts Database.

***National Spatial Data Infrastructure Examples of Success Through Data Sharing,* Norman E. Gunderson.** The presentation will concentrate on Executive Order 12906 that established the National Spatial Data Infrastructure (NSDI) and discuss examples of how federal, state and local programs have been expedited through sharing of geospatial data. The role of the Federal Geographic Data Committee (FGDC) in promoting data sharing will be discussed, as well as a variety of products that have been developed by federal agencies to make their geospatial data available to other potential users.

There are three integrated components of the presentation: the NSDI, the FGDC itself with its coordination task, and examples of the principles of the NSDI at work. The second part of the presentation describes three applications that demonstrate the advantages of data sharing among agencies:

- LandView, a desktop mapping program developed by a partnership of EPA, NOAA, the Bureau of the Census, and the US Geological Survey
- Community 2020**,** a tool offered by the Department of Housing and Urban Development (HUD) that enhances the ability of HUD grantees and the public to access demographic and neighborhood information at the local, regional, and national levels.
- The National Transportation Atlas Data (NTAD), a set of transportation-related geospatial data for the United States developed under a cooperative effort throughout the U.S. Department of Transportation and other federal agencies.

***Archived Resources for Crime Mapping Available at ICPSR,* Kaye Marz.** The National Archive of Criminal Justice Data (NACJD) archives a variety of crime mapping resources and data for NIJ's Crime Mapping Research Center (CMRC). These include:

- CrimeStat® spatial statistics program
- A case management and mapping application
- Crime mapping tutorial
- A survey of computerized crime mapping by law enforcement in the United States, 1997-1998
- An examination of crime guns in Pittsburgh, 1993-1998

All these are freely available and accessible to anyone from the NACJD web site. This presentation will focus on finding, obtaining, and demonstrating these resources.

School Safety: Case Studies

A Mapping and Crime Analysis Tool for Enhancing School Safety, **Thomas F. Rich.** The National Institute of Justice provided funding to Abt Associates to develop and test a software application for supporting crime prevention and problem solving efforts at elementary, middle, and high schools. The application will enable school safety officers or school administrators to enter, maintain, analyze, and map school incidents (both criminal and non-criminal), victimization data, and attitudinal data regarding school safety. The underlying rationale for this software application is that it will improve decision making on school violence prevention and help build support for school violence prevention initiatives. The application will not require any special software or software licenses to run, other than the Windows operating system, and will be offered free of charge to any interested school district or other user. The software is currently being pilot tested at a small number of schools, and a fully-functioning package will be available in April 2001.

The presentation will describe this approach to mapping, discuss the methodology and results of recently conducted map-based school safety surveys, and discuss our software implementation and distribution plans.

Jersey City/Police Foundation Safe Schools Partnership, **Mary Velasco, Rachel L. Boba, and David Weisburd.** The Police Foundation, in cooperation with the Jersey City Police Department and the Jersey City Board of Education, has developed a partnership with the goal of improving information sharing and responses to school related crime in Jersey City, New Jersey. Funding for this objective was obtained through the National Institute of Justice's Safe Schools Technology Solicitation in 1999. The Jersey City Police Department and the Jersey City Board of Education are currently partners in the School Based Partnership program sponsored by the Office of Community Oriented Policing. The Jersey City/Police Foundation Safe Schools Partnership has built upon this existing relationship to enhance the partners' goal of safer schools by advancing their technical capacity to capture information concerning incidents of school related crime and calls for service.

The goal of this project is the develop a cutting edge geographic information system for tracking crime and calls for service in Jersey City elementary, middle, and high schools and in surrounding neighborhoods. The Jersey City safe schools geographic information system will rely on data provided by the Police Department and the Board of Education and will emphasize accessibility and usability. The application will guide users through a set of easy to use windows and pull down menus to perform quick analyses, create maps, and produce reports. The system will designed for the Jersey City public school system; however, the application will be compatible with commonly used PC systems and with available mapping software programs. Upon completion of this project, the Jersey City application will be available for use by police and education personnel throughout the country along with both a technical manual and an analysis guide.

Role of Spatial Analysis in Environmental Criminology

The Role of Spatial Analysis and Geographic Information Systems in Environmental Criminology, **Patricia L. Brantingham and Paul J. Brantingham.** Environmental criminology is concerned with the role of place in the commission of crime. It examines questions such as (1) How do motivated offenders find out about targets? (2) Why are some places victimized more than other places? and (3) What is the interaction between characteristics of the place and characteristics of the individuals who frequent that place in generating and sustaining crime patterns? In other words, environmental criminology is concerned with why crimes occur where they do in space. This session will make explicit the links between environmental criminology, geographic information systems, and spatial analysis. It will provide attendees with a clear understanding of how GIS and spatial analysis can be used to develop and test theory.

Journey to Crime and the Geography of Serial Offenders

***Putting Crime in Its Place: Psychological Process in Crime Site Selection,* David Canter**. How and why offenders decide to offend where they do is given little consideration in most geographical modeling of crimes. Geometric calculations are applied to crime location data taking no account of the offender's cognitive processes. If the offender's behavior is considered, it is usually only in terms of the simple logic of optimizing benefits while minimizing efforts. This cost-benefit logic tends also to be based on the equally naïve assumption that criminals have an informed understanding of the distribution of opportunities for crime. Yet for well over 40 years, it has been clear that nobody makes use of their physical environment like an efficiently programmed automaton. There are many biases and heuristics built into cognitive representations of surroundings that influence what people do and where. There is growing evidence that criminals are probably even more prone to distorted mental representations of what is criminally possible. Future improvement of crime mapping systems will therefore need to take account of psychology of place.

Criminal cognitive strategies are illustrated from offense series and interviews with offenders. Person-environment transactions from non-criminal models facilitate study of people's use of place. These also avoid animal analogies, i.e., "predator," to emphasize cognitive processing rather than exotic rhetoric that implies only base, atavistic instincts. In different ways, criminals all weigh the risk of detection in a dynamic that is different from other human spatial behavior.

Satisficing. This is the strategy of specifying the effort to be expended in advance and then obtaining whatever is possible within that time and space constraint. It characterizes local "small time" offenders who are dependent on vulnerable sources (typically "marauders" in Canter and Larkin, 1993).

Connoisseur Selection. Here, the target is of the essence. This strategy may lead to traveling greater distances to locate the desired "product." Individuals who use this strategy over a longer period of time may use their home as a base. Many serious robbers and shoplifters illustrate this strategy.

Collection Runs. The selection of an offense route is the dominant strategy, often influenced by public transport opportunities. Examination of a number of rape series in Manhattan illustrates this process.

Career Commitment. When criminal careers unfold over long time periods, a mixture of strategies are used, indicating increased sophistication in using route opportunities, risk reduction, and target selection.

Offenders combine strategies in different times and stages in their careers. The task is to model the major components in the strategies: (a) the time frame, (b) the targets, and (c) the stage of criminal career when incidents occur.

***Utility or Futility? Provisional Examination of the Utility of a Geographical Decision Support System,* Brent Snook and Gareth Norris.** The current study tested the extent to which the use of a geographical profiling system (GPS) represents an increase in utility. Students were compared to a GPS known as 'Dragnet' on their ability to predict the home location of 10 serial offenders from the information provided about where they committed their first five crimes.

In the control group (n=21), students were asked to place an "x" on the map corresponding to where they thought the offender lived. A few minutes later, the students were asked to complete the task again. In the experimental group (n=21), students were asked to place an "x" on the map corresponding to where they thought the offender lived. Then subjects in the experimental group were informed about two principles upon which geographical profiling systems are built (i.e., distance decay and circle hypothesis) and were asked again to complete the task. Results confirmed that students with no previous knowledge of geographical profiling were able use the two principles to improve the accuracy of their decisions once provided with the two principles. Furthermore, the findings supported the idea that students trained on the principles of geographical profiling are able to make geographical

decisions as accurately as Dragnet. The implications of the results and future research issues are discussed.

GIS and Juvenile Justice Issues: Research and Practice

Using GIS to Analyze the Association Between Violent Crime and the Routine Activities of Youth, **Caterina Gouvis.** Using a routine activities framework, this presentation will analyze the temporal and spatial patterns of violent incidents against youth in the Washington, D.C. metropolitan area. The analysis examines different time periods that coincide with activities associated with attending school, based on the belief that activities within the time periods influence the number of offenders, targets and guardians that are available, and (in turn) increase or decrease the opportunities for crime to occur. The study utilizes a number of locational features, including schools, bus stops, parks, recreational centers, and major transportation routes. Implications for target hardening will be discussed.

Mapping for Risk Focused Policing, **Christopher Catren.** In 1997, the Redlands Police Department (RPD) developed the concept of Risk Focused Policing. Risk Focused Policing is defined as a data and results-driven, community-oriented policing and problem solving strategy which focuses on those factors in a community that place its youth and their families most at-risk for criminal and other problem behaviors. The purpose of this new approach is to address the issues that adversely affect the community's youth *before* exposure to these risk factors causes problem behavior.

The research behind this policing framework indicates that there are several identifiable risk factors that, if allowed to accumulate, place youth at a higher risk for problem behavior. Risk factors fall into four domains: (1) community, (2) school, (3) family, and (4) individual/peer. Each domain contains several identifiable indicators such as availability of drugs and firearms, low neighborhood attachment and community disorganization, and academic failure beginning in elementary school.

The Community Analysis Unit of the RPD has been researching, compiling, and developing geographic data related to the identified risk factors for over three years. In 1997 and 1999, the RPD and the Redlands Unified School District collaborated with a research organization to survey middle and high school students to determine their levels of risk relative to several identified risk factors. This information has been used in conjunction with a variety of other types of data to identify the areas of Redlands in which youth are at a substantially higher risk of developing problem behaviors. The identification of defined, high-risk areas provides the RPD and a community collaborative with critical information used to determine where services for youth and others are more desperately needed. Once identified, services are provided to high-risk areas first, to leverage the prevention efforts of the RPD and its community partners.

General Session, Monday, 8:30 a.m. – 10:00 a.m.

Conversation with Mapping Vendors: Opportunities for Q&A

We Don't Need No Stinkin' Vendors. Do We? **Christopher S. Gebhardt.** An interesting process occurs when agencies begin to build mapping systems. Inquiries are made of other agencies doing mapping. "What vendor did you use?" "Do you like them?" "Why not?" "How much did it cost you?" "You had to auction what to pay for that mapping system?!?" Government agencies are often used to one-time purchasing. However, with mapping and most information technology, initial purchasing is not the end of the relationship. Expectations continue to grow within the agency, and as expectation levels grow higher so do mapping budgets.

This plenary panel features several popular GIS vendors/contractors sharing with participants the ins and outs of creating a relationship with the vendor. Agency representatives can learn what it takes to create a successful relationship with the contractor. More importantly, participants can learn what mistakes not to make. The host will be asking questions of the panel and these will include tough questions: "Why does mapping software cost so much?" "How come it does not work on the initial installation?" Time permitting, audience members will be allowed to ask questions too.

Come learn the intricacies of the vendor/agency relationship. Remember, without vendors/ contractors, most of us would still be back in the days of tacks on the wall.

Concurrent Breakouts, Monday, 10:30 a.m. – 12:00 p.m.

International Approaches: Crime Mapping in South Africa

Mapping Crime Scenes and Cellular Telephone Usage, **Antony K. Cooper and Peter Schmitz.** Project staff have successfully used a desktop geographical information system (GIS) to plot cellular telephone conversations made during the commissioning of several crimes, such as car hijacking, hostage taking, kidnapping, rape and murder. The maps produced in this manner have been used in three court cases as part of the prosecution's evidence against the accused. Two of the cases resulted in successful convictions, while third case is still before the court. The first case involved the hijacking of a motor vehicle, hostage taking, and the subsequent rape and murder of the victims. The second case involved the shooting of four victims by an individual. In both cases the maps were crucial for obtaining the conviction and sentencing of the accused. The third case involves the kidnapping of a businessman for ransom.

Integrating Linkage Analysis and GIS, **Peter Schmitz and Antony K. Cooper.** This paper describes a project wherein researchers attempted to establish whether or not it is possible to link cellular telephone calls by integrating a linkage analysis tool, such as Analyst's Workstation, with a desktop geographical information system (GIS). The project used integrating software provided by the developers of Analyst's Workstation and data from a completed court case, for which a manually prepared, computer generated map had been successfully used. The results of this project were similar to those obtained earlier with manual mapping of the data.

Mapping for Special Applications: GIS as a Tactical Tool

Mapping as a Planning and Tactical Tool for Law Enforcement, **Ronald Rasmussen.** Many law enforcement agencies have acquired systems in the past few years to map their crime data. Additional value can be leveraged from these systems if they are used to help the agency to plan for major events such as parades, demonstrations, conventions, and dignitary visits. Using the mapping system for this purpose, planners can "see" the places to which they need to assign people for crowd or traffic control. Building and event security issues, such as access points, security points and checks, and evacuation routes can be planned. Use of the software may allow for better estimates of personnel needs and actual assignments can be made via the system. Command and control of a planned event, can be significantly improved by using the mapping system because of the information available to the commanders.

The Seattle Police Department uses GIS in mapping and event planning. This presentation will show examples of the system during World Trade Organization and other special events and will show the benefits and limitations in GIS as a planning and tactical tool.

GIS and Alien Smuggling, **Brandon Steele.** The Border Patrol, as the mobile uniformed enforcement arm of the Immigration and Naturalization Service, has as its mission the detection and prevention of the illegal entry and smuggling of aliens into the United States. Patrol agents perform their duties along and in the vicinity of some 8,000 miles of international boundary by automobile, boat, aircraft, and afoot.

Most of the areas patrolled by the Border Patrol are remote, with unnamed and un-maintained dirt roads. As a result, the Border Patrol has not had the ability to geocode events using street maps as many law enforcement agencies do. Knowledge of operational areas has typically been passed on from agent to agent during the field training process, and events are tracked by large zones created by natural boundaries.

With the revolution in desktop computing, this has changed. The Border Patrol now uses ArcView GIS and the global positioning to map out operational areas, track events, and analyze smuggling patterns. They have combined GIS with other technological advancements, such as bio-metric identification, to conduct unprecedented analysis on smuggling activities.

Mapping for Corrections

RAP MAP: Using GIS as a Tool in the Evaluation of Risk when Releasing Offenders into the Community, **Peter Eberhardt.** This presentation will discuss various aspects of applying GIS to evaluation of risk when releasing offenders into the community. This project is the result of a collaborative research and development effort between Lane Council of Governments, Lane County Adult Corrections, Lane County Custody Referee and Lane County Probation and Parole. The project is funded in part by a two-and-a-half-year $300,000 technology grant from the Department of Commerce Technology Opportunity Program (TOP).

This presentation will focus on: (1) a methodology for the construction of an interagency risk assessment data warehouse; and (2) developing an interagency GIS application for risk assessment using Internet mapping technology. Products and lessons learned as a result of this research effort will be applicable to other agencies concerned with public safety risk assessment activities.

Using Crime Mapping and Analysis in Community Corrections Knock and Talks, **Fran Smith.** This presentation demonstrates how the Seattle Police Department and Washington State Department of Corrections (DOC) staff worked collectively to monitor supervised offenders within the various police precincts. Staff have used ArcView, Spatial Analyst, Excel and the Internet to help Community Corrections Officers prioritize their home visits. The Department created density grid maps for hot spot analysis and examined offender address points for relationships to crime. MO similarities within the areas of highest crime density were noted.
A protocol was developed cooperatively between DOC and SPD to conduct "Knock and Talks." The resulting strong communication network between DOC, SPD, and the Attorney General's Office enhanced adoption of the AG's SMART program (Supervision Management and Recidivist Tracking). In the near future follow up units and Crime Analysts will be able to query the SMART database for case investigations.

Planned and Serendipitous Mapping Applications of a Probationer-Police Database in a Large Adult Probation Department, **Vincent J. Webb, Jodie Fisher, Marie Griffin, Robin Haarr, and John Hepburn.** This presentation describes the development and use of GIS mapping in a large adult probation organization, the Maricopa County Adult Probation Agency in Phoenix, Arizona. A National Institute of Justice grant made it possible for the agency to begin to develop a mapping capability. As part of the grant, a shared database combining probationer information with police

contact and incidence data provided by the Phoenix Police Department was developed. The intended outcome of this mapping capacity building effort was to develop mapping applications in support of joint probation and police problem solving efforts. Examples of mapping applications used as part of the problem-solving component of the project are described. In addition, the development of a mapping capacity in the probation agency resulted in several applications in support of the agency's mission. These applications are described in detail and an assessment of their utility is provided.

Examining Enviornment and Design

Crime Mapping and the Architectural Design and Planning Process: Utilizing the "Brantingham Method" of Neighbourhood Crime Study, **Mary Beth Rondeau.** Crime prevention should be considered at the earliest stages of the architectural design and planning process whether for a building, a city block, or planned neighborhood. A method for incorporating crime into the architectural design process has been developed based on the work of the Drs. Patricia and Paul Brantingham in the field of environmental criminology. This method includes analysis of information from police crime data, police patrols, the site, surrounding uses, and consultation with neighborhood groups.

The crime data provided by police department can give invaluable information to the architect or planner on a given project. This data becomes a "crime picture" that can be developed by the architect or planner to positively impact the design. An example of a neighborhood in Vancouver, British Columbia, that is centered around a rapid transit station will be discussed. Crime maps initially showed clustering of various types of crime: car crime, breaking and entering, and robbery. Further analysis suggested that the clustering occurred for primarily three reasons generated by the rapid transit station and pathways to and from that station. By establishing the primary generators for the crime in the neighborhood, the design solutions for the built environment and community programs become apparent.

Recommendations for architectural design, planning, and community programs that reduce opportunities for crime will be presented. Maps that illustrate the layers of primary generators for the crime, developed in conjunction with CPAL (Crime Prevention Analysis Laboratory), will also be presented.

Shadows and Light: Impact of Streetlights on Residential Auto Theft, **Jeffrey S. Vandersip.** Common sense dictates the idea that streetlights help create safer neighborhoods. However, the results of several studies that have attempted to prove this relationship have been generally inconclusive. Perhaps this is due to the possibility that crime is displaced from lighted areas into the shadows, rather than disappearing altogether. This study examines the impact that streetlights make in the pattern of residential motor vehicle theft in the small California city of Carlsbad; it incorporates residential areas of Carlsbad where nighttime auto thefts were most highly clustered from December 1995 through June 1998. The study shows how streetlights impact the spatial distribution of nighttime auto thefts. My aim is to show, using statistical techniques in a GIS environment, that most residential auto theft in residential areas occurs in relative darkness, away from the boundaries of illumination.

Mapping Juvenile Activity

Using GIS to Route Juvenile Court Counselors: Reducing Planning Time and Maximizing Field Time, **Eric K. Fisher, Brendan Ford, and Scott Warner**. The Fairfax County Juvenile and Domestic Relations District Court in conjunction with Fairfax County's Department of Information Technology, Geographic Information Services Branch, is developing and implementing a GIS routing application using ESRI's ArcView GIS software with the Network Analyst extension. The purposes of this application are to more efficiently route counselors in the field and to better manage the caseload of 50-70 juveniles in the Supervised Release Services (SRS) program.

SRS offers an intensive supervision alternative to the Juvenile Detention Center and Less Secure Shelter for juveniles who are waiting for either a trial or final disposition of their cases. SRS includes both outreach and electronic monitoring components. Each component provides for face-to-face contact with juveniles at least every other day, including weekends. Juveniles on outreach are given a court-ordered curfew or placed on house arrest. Juveniles on electronic monitoring are on strict house arrest, with an exception for attending school. Counselors make visits to youths at home or in school four times a week or more. The Court has the responsibility of managing a caseload of 50-70 adolescents who have been assigned to the SRS program with a staff of five. Most of these children attend school during the day and are on house arrest the remainder of the time. The average length of time a child is in the program is about 40 days. Each week, some juveniles may be added or removed from the active list of cases.

Why GIS? The Court initiated the project based on several factors, some generic to any routing application, some specific to the Court's program. The simple task of finding where these children live was very time consuming under the old system. This group of counselors must balance the caseloads among the staff and factor in new case locations. With the new GIS application, a single person enters new case information into the SRS Access database. This Access database has an ESRI MapObjects component that geocodes the case locations. This information is stored as part of an active case data layer. Location information is determined just once and doesn't have to be repeatedly and manually determined each time a counselor prepares to visit a juvenile.

A second problem under the old system is finding the homes in some cases. The County hardcopy mapping products are sometimes not as current as needed to find certain home locations, and commercial maps used by the staff often do not have the level of detail needed to accurately pinpoint a home's location. Using the online street centerline and parcel data layers, the cases are accurately located when they are entered into the database. This allows for quick routing solutions. Counselors can use the case data layer in ArcView to equitably divide caseloads based on geographic factors such as location and travel time. Previously, two counselors with the same number of cases but may have had vastly differing workloads if travel time were considered.

Finally, ArcView is also used to plan the optimal travel routes for individual counselors to visit their cases. Using a customized version of ArcView, the counselors can generate maps and directions to assist in fieldwork.

***Recovering Missing Children,* Geraldine P. Kochan.** The National Center for Missing & Exploited Children (NCMEC) assists parents and law enforcement agencies in locating missing and abducted children. By distributing a missing child's photograph through a network of photo partners, lead information is developed about the child and abductor. In addition, information on former and/or present addresses of the abductor is gathered from the public record databases of ChoicePoint and AutoTrack. A predictive modeling research project was initiated using ArcView in a review of successful recoveries involving Family Abduction cases. Evaluation of the maps and search for patterns has produced an institutional change in the geographic locations of poster distribution. With the introduction of MapObjects, an interactive mapping program has been created which allows case managers to access geographic visual representations of leads to aid them in identifying the locations and subsequent capture of the abductors. Using the NCMEC Intranet, this program will eventually allow law enforcement to access this information.

***Integrating GIS in Juvenile Justice Planning: A Spatial Framework for Juvenile Justice Planning,* Sanjeev Sridharan**. The presentation will focus on an application of the linkages between geographical information systems and spatial econometrics for juvenile justice planning.

The presentation will explore the utility of spatial data analysis and spatial panel data analysis in forecasting and explaining changes in juvenile violent crimes. County-level measures of community well-

being, risky behaviors, school risks, children's health, and family risks will be used as predictors of juvenile violent crimes in the spatial models. Both exploratory and confirmatory approaches will be used to examine the spatial and temporal factors associated with changes in juvenile violent crimes between 1991-1998. A key part of the project is the integration of the research activities within a policy setting.

Moving Beyond the Descriptive: Innovative GIS Applications

Integrating Time and Space in Tactical GIS: Technical Showcase for Advanced Professional Crime Analysts, **Dan Helms.** Important research on the nature of time relative to acts of crime has long been accomplished. In recent times, the advent of desktop GIS environment has encouraged research of similar quality with respect to space; however, many practitioners have maintained an artificial separation between considerations of space and time. The power of readily-available software enables the progressive tactical analyst to integrate these two inseparable factors. The presentation will endeavor to expose practicing crime analysts (already familiar to some degree with the power of temporal and spatial analysis as separate entities) to some useful techniques for analyzing a dynamic, spacetime environment that incorporates both factors. Students will see first-hand how these techniques can be immediately employed in their own agencies using common software.

Using Unconventional ArcView Extensions for Law Enforcement Tactical and Investigative Purposes, **Steve White.** This presentation focuses on using Spatial Analyst and Animal Movement extensions for ArcView to analyze suspect actions. Emphasis is placed on analysis of suspect movements between hits and how it may assist patrol officers and supervisors in formulating tactical plans. Follow-up investigators' use of this information for interrogation planning and prosecution preparation will also be discussed.

Luncheon and Keynote Speaker, Monday, 12:00 p.m. – 1:15 p.m.

Hot Spots and Social Networks: The Next Synthesis in Crime Analysis

Hot Spots and Social Networks: The Next Synthesis in Crime Analysis, **Lawrence W. Sherman.** The mapping of crime events by offense type has grown widespread in the past decade, with many uses in patrol operations. Investigative units have had less interest in this tool, in part because they cannot put names of suspects onto the hot spots. Mapping strategies that can lead to both crime prevention (as in early warning of revenge shootings) and to prosecution may depend not just on *geographic* space but on *social* space as well. Mapping of co-defendant relationships in social space, superimposed onto geographic space, may be a tool that can catch the imagination of investigators and lead to new efforts at violence prevention.

Concurrent Breakouts, Monday, 1:30 p.m. – 3:00 p.m.

Census 2000: Data Sources, Analysis, and Applications

Census 2000: Data Sources, Analysis, and Applications, **Keith Harries.** The fact that 2000 is a year for administration of the decennial Census of Population and Housing means that results of the census will start flowing beginning in 2001 and continuing for several years as various tabulations are completed. Since the 1990 census, there has been a sea change in the way census products are accessed, with relatively recent emphasis on the Internet. Given that crime analysis demands the availability of a wide range of data, including demographics and other social and economic detail, a

review in this year of the census is timely and will prepare analysts for the data stream that will emerge in the near future.

This workshop will demonstrate how census data and census geography may be obtained and utilized in the context of crime analysis. In the past, one of the most notable features of the application of census data has been its indiscriminate use. For example, sample data for small areas may have been used without recognition of the large errors potentially lurking in such data. Furthermore, users have generally not understood what measure, among several possible, might be most appropriate. For example, what income measure should one use: median, mean, per capita, or family?

It is also proposed to outline the various census products that can find application in crime analysis, such as the new American Community Survey and data from the other censuses, such as the Census of Business. Participants will learn the fundamental elements of census geography and census data compilations and will learn how to access and manipulate this data. They will also learn some caveats to observe in the use of census information and will gain insights relating to how census data and crime analysis can be related in beneficial ways.

Exploring New Tools for Crime Analysis

Pattern Discovery Services, Part I: Developing a 'Spike Detector' for Finding Anomalous Activity in Large Crime Databases, **Robert Cheetham.** Large, urban police departments face a special set of challenges vis-a-vis crime analysis and mapping. Unless substantial resources are devoted to the effort, the sheer volume of events to which they must respond often relegates the crime analysis and mapping effort to one of descriptive cartographic production rather than a more analytical or prescriptive process. While the use of mapping to more effectively visualize events and the relationships between them has been a valuable addition to the information management tool box of urban police departments, it is only a portion of the contribution that might be made by spatial analytic techniques. Indeed, advances in information processing capacity are rapidly bringing an entirely new generation of statistical and database tools within the financial and technical reach of mid-size to large law enforcement agencies. These new methodologies do not limit themselves to merely descriptive maps but use spatial and attribute information to discover patterns in the volumes of data that would not otherwise be revealed. Unfortunately, many of these techniques remain speculative and untested against crime data. This paper will explore the use of one such technique intended to discover anomalous spikes in criminal activity. The research will use the six million incident records in the Philadelphia Police Department's incident database from July 1, 1997 to July 1, 2000 as well as arrest databases to refine the technique and explore its effectiveness and applicability for other police departments.

Using Weights-of-Evidence Modeling as a Tool for the Spatial Prediction of Crime, **Fraser Moffatt.** Weights-of-evidence modeling ranks among the better-known, data-driven predictive modeling techniques such as logistic regression and neural networks. Like these other techniques, weights-of-evidence modeling uses existing data (training data) to predict a probable outcome. The spatial dimension further complicates predicting probable outcomes in that these outcomes will tend to vary over space. The use of such a model in a GIS makes computing these outcomes much easier. This applies to crime mapping in a two ways: first, predicting where general criminal activity is likely to occur can affect resource deployment; second, predicting where specifically linked criminal activity is likely to occur can help solve cases.

Weights-of-evidence modeling employs the conceptually simple notion of "multiple map analysis" where an output map is a function of two or more input maps. The function used in weights-of-evidence modeling is empirical, based on observations of data, in this case, point

observations of criminal activity. These point observations are weighed against underlying characteristics of the space that these occurrences occupy. These are layers of evidence and could include: demographic characteristics beyond a certain threshold, distance/proximity variables and/or the presence or absence of any other specific locational characteristics. The ultimate output is a "probability surface" map, a raster-based map output of the probability of the occurrence of further criminal activity. Areas defined as having a "high probability" would denote where criminal activity is likely to occur again.

The research being done at OCRPS right now is concentrating on the scale and scope of modeling and leading indicators required for input into the weights-of-evidence model, including supports necessary to produce a statistically valid outcome. Once these factors are identified, some relatively simple manipulation is required to plug data into the model.

Community Safety Information System (CSIS): What It Is and How It Works

***Community Safety Information System (CSIS) in Winston-Salem, North Carolina,* Julia B. Conley.** Winston-Salem, North Carolina, was the first community to develop a Community Safety Information System (CSIS) as part of the Department of Justice (DOJ) sponsored Strategic Approaches to Community Safety Initiative (SACSI). The Winston-Salem initiative has successfully focussed on implementation of research-based strategies to reduce and prevent juvenile violence. CSIS, an Internet Map Server application that integrates diverse community data from multiple agencies, was developed as an analytical tool to assist the local SACSI efforts. The challenge to complete the development of CSIS and enhance the application to successfully meet community needs was accomplished with local effort and some additional support from DOJ and Indus Corporation, the developer. Most recently, CSIS has been enhanced to integrate calls for service and support arrest queries. The home addresses of offenders have been added as another GIS layer that can be accessed by this application. An additional flag has also been added to indicate those offenders who have been notified by SACSI agencies of intervention resources available and consequences of continued violent behavior. CSIS has been designed to simplify the integration of additional GIS layers, which allows the application to evolve as shifts in emphasis occur. The SACSI initiative has been awarded a $1.8 million grant from a local charitable trust to establish a Center for Community Safety at the Winston-Salem State University campus, which will enable the program to continue to reduce juvenile violence and improve community safety.

***Motor Vehicle Theft in Winston-Salem, North Carolina,* Yvetta M. Thomas.** The Winston-Salem Police Department (WSPD) determined that motor vehicle thefts had risen sharply (65%) in the community over the previous three months (January to March, 2000) compared to the same time period last year. From January through the end of March 2000, 54 percent of the arrestees for vehicle thefts were juveniles. As part of the DOJ sponsored Strategic Approaches to Community Safety Initiative (SACSI) in Winston-Salem, a multi agency violent incident review team meets weekly to review juvenile crime incidents. This team consists of juvenile probation officers, WSPD staff (including those working in the Juvenile Repeat Offender unit), U.S. Attorney staff, and the Sheriff. This team became aware of the shift in juvenile crime activity to motor vehicle thefts and attempted larcenies. A special WSPD auto task force was assigned to look at the problem.

To support these efforts, the Information Systems Division created multiple reports that help to define the patterns and scope of the vehicle thefts. Using offenses and vehicle recovery locations entered in the Records Management System (Oracle RDBMS), project staff generated both overview reporting by beat and sector and arrestee reports by age ranges, incident offense (including details of M.O.), victim, suspect, vehicle recovered location, make, model, color, etc.

Data layers were developed based on both the offense and recovery locations. Motor vehicle theft incident addresses were extracted from WSPD Oracle 7.3 Records Management System with Crystal Reports 7.0 and exported into Visual FoxPro 6.0 database file (dbf). The dbf was added to ArcView 3.1 and address-matched. Motor vehicle recovery addresses were also extracted and address-matched. Maps were generated for the four sectors and for individual police beats to assist in the initial problem identification. Thematic mapping by fire demand zone and beat frequency were used to define the most problematic areas. We found that 80 percent of the recovered vehicles were located in two police beats (220, 230). A process was initiated to extract and geocode the motor vehicle theft and recovery locations on a bi-weekly basis. These layers are used to generate maps of the four sectors and 24 city beats for the two-week activity periods.

Sucessful Case Studies: I

Using GIS in a Command Post Center: Search for Joseph Palczynski, **Philip R. Canter.** It is believed that little, if any, literature exists on the use of a GIS in a police command post center during a critical incident. This presentation discusses the interactive use of GIS in a command post center during the search for a 31-year-old suspect wanted in four murders and a kidnapping. In Baltimore County, Maryland. The suspect, a convicted felon with a history of mental problems, had extensive experience living in the woods. The search area involved a wide range of land uses and geographic locations including densely populated areas, heavily wooded state parks covering multiple jurisdictions, and other parts of Maryland, Pennsylvania, Virginia, and West Virginia. Analysts used GIS to track the suspect's stolen vehicle in real time; map data from various sources such as confidential files, intelligence information, 911 CAD data, and information provided to the Tip Hotline for linkage analysis and subsequent surveillance; establish tactical perimeters during the execution of searches; provide topographic and aerial photography of grid search areas; use Web-based GIS mapping to assist in the investigation of a homicide in Western Maryland initially thought to be attributed to the suspect; integrate information from public works into a GIS; use of the department's autodialing system; incorporate geographic data to explore the suspect's use of transportation routes and modes; establish a "kill zone" perimeter based on aerial photography and planimetrics around the home used by the suspect for holding hostages; and the use of GPS to direct aircraft to specific search areas. This presentation will also address additional considerations for use of GIS and information systems during critical incident situations.

Restoring Community Order Through the Application of Simple Spatial Analysis Techniques: A Case Study, **K. Michael Reynolds and R. Cory Watkins.** South Orange Blossom Trail in Orlando, Florida, has received nationwide recognition as a home for drug dealing and prostitution. This four square mile area located in Orange County, Florida has accounted for roughly 70 percent of all drug and prostitution crimes for many years. In a joint effort with Orange County Sheriff's Office, Orange County Code Enforcement, residents and business owners, researchers from the University of Central Florida conducted systematic field observations and used a variety of spatial analytic techniques to explore the nexus between drug dealing and prostitution on South Orange Blossom Trail.

Over the past three decades, increasing concern about the relationship between narcotics and prostitution has developed among civilians, officials, and criminal justice practitioners alike. Much literature exists to explain the development and dynamics of illicit retail markets, but the nexus between drugs and prostitution deserves further empirical attention. All measures of traditional law enforcement suppression and containment activities have failed to curtail the community decline.

The collaborative effort endeavored to explore this problem in depth and generate innovative techniques to address the problem of drugs and prostitution. Using a systematic field observation

methodology and baseline measures of true prostitution and drug distributions, frequencies in designated experimental and control areas were established. Crime mapping and simple spatial analytic techniques were used to identify specific environmental features that collectively contribute to community disorganization. Results from the analysis significantly assisted the partnership in developing an innovative approach that has dramatically reduced the level of social disorder and resulted in immediate community improvement.
The showcase is designed for beginner to intermediate level GIS users. Spatial analytic techniques are detailed and demonstrated through a series of static maps, animated maps, and a simple step-by-step "how to" guide.

GIS for Problem-Oriented Policing, **Matthew White.** GIS, with its reputation as an effective data integration and dissemination tool, was employed to facilitate the information sharing and partnering required for a dynamic community-based effort. By integrating the disparate data sets from multiple municipal agencies, GIS provided a more holistic picture of where (and to what extent) the various government agencies were involved in local communities. Among other insights, the findings revealed that troubled neighborhoods required substantial focus and collaboration from service providers. Throughout these processes, GIS capabilities have given a unique ability to assimilate information and facilitate progress. GIS continues to be used in building partnerships, analyzing data, and enabling better informed decisions via intuitive, informative mapping and charting. Every step taken in these initiatives represents a paradigm shift in how local government agencies can conduct business. The presentation further sheds light on the role GIS can play in fueling such a movement.

Evaluating the Impact of GIS Implementations

Assessing the Value of Crime Mapping Systems, **Craig Fraser.** Frequently, police departments acquire technology on faith. The assumption is that new technology will improve police operations and make then more efficient and effective. Little thought is given to just how new information systems like crime mapping systems will have an impact on operations and how to document the value of such systems to the agency.

This presentation offers a framework for assessing crime mapping systems in order to document what they add to police departments. By closely examining the possible impact of such systems and focusing on the logic behind their development, departments can not only better justify the cost of implementation but also implement such systems more successfully.

The Impact of Crime Mapping in Detroit, Michigan, **Russell DeCrease**. In October 1999, the Hudson-Webber Foundation awarded a grant to the Detroit Police Department and Wayne State University (WSU) to train approximately 3,000 police officers in a new computerized crime-mapping system. The Detroit Police Department's Computer Automated Mapping System, (C.A.M.S) was developed through the efforts of the Major Crimes Division with assistance from WSU's Urban Safety Program.

The system uses ArcExplorer software to provide daily information in map form to police officers, and it allows supervision to maximize resource allocation across the city. To date (April 2000), approximately 1000 police officers have each received five hours of classroom training utilizing C.A.M.S.

For this project to be totally successful it must expand and meet the needs of all levels within a police department. A major pitfall that projects can fall into is when they exclude the end users from participation and providing a product they simply believe to be most useful.

This project features a rigorous evaluation. Key research questions focus on the use of the

system by all levels, officer data needs, officer opinions on the utility of mapping, and the actual impact of crime mapping on resource allocation and crime levels. The data sources used:

- ? Police officer survey data
- ? Focus groups
- ? Crime incident data

Evaluation data has been collected from police officers. The system is accessible citywide at all police department PCs. Top department executives are using the system to identify neighborhoods needing special attention while specialized units such as the B&E Taskforce, Robbery Armed Taskforce, and the Gaming Division monitor crime patterns and use the system daily to help apprehend repeat offenders. Officers have apprehended criminals through their observation using C.A.M.S and have received meritorious awards for their effort.

Pasadena Police Department Crime Analysis Partnership Project: Beyond Cops on Dots — Maps Making a Difference, **Mary L. Schander.** The Pasadena Police Department Crime Analysis Partnership Project is a groundbreaking collaboration between a public agency and a private corporation to develop a crime analysis/mapping system that uses existing information sources from legacy systems. The effectiveness of the collaboration is being evaluated by a prestigious independent agency.

This innovative project has three aspects. First, the partnership between a policing agency and a private corporation to research, develop, and test a practical approach to crime analysis is unique. The Pasadena Police Department is actively working with a private company as a development test site. This partnership maximizes the public's investment in the Department.

Second, this is a pioneering approach to systems development and data mapping because it integrates the information from diverse systems such as parole, probation, registered sex offenders and the existing legacy CAD/RMS systems of the Pasadena Police Department. The Pasadena Police/ Motorola Partnership project links existing databases from multiple sources and legacy systems to provide a crime analysis and mapping backbone for individual agency and regional crime analysis.

The third innovative aspect is the evaluation by an impartial outside agency, the Police Executive Research Forum. The evaluation does not focus merely on whether the programming functions as designed but addresses the impact on the decisionmaking process for successful deployment of law enforcement resources. The purpose of development of law enforcement systems and crime mapping is not only to identify sites of criminal activity, but to intervene and interrupt the crimes. Crime mapping and analysis systems must be tools used to make a difference in the communities served.

Advanced Hot Spot Methods

Parameter Selection for Surface Representation of Crime Density, **Jason R. Dalton.** Spatial analysis of coordinate data is used in many areas of research, business, and government. Techniques for discovering patterns in these data are used to find regions of high data density or to create decision classifiers where prior knowledge of the class structure is present. This paper applies a new method of bandwidth selection for the statistical technique of kernel density estimation (KDE). KDE is a useful technique for establishing surfaces of density distribution for data where little is known about the underlying classification structure. It is hoped that this new technique will aid in the development of tools for the analysis of hotspots of criminal activity based on the point process data collected by police agencies. Such analysis would give a statistically sound basis for policy decisions such as patrol zone adjustment and assignment of extra patrols to high crime areas, increasing efficiency and decreasing crime levels without increasing the use of limited funds. The paper demonstrates the use of computational geometry to find an algorithm for the standardized bandwidth. This bandwidth is

defined as the standard deviation of the Gaussian kernel, which gives the cumulative density surface that most closely approximates a Euclidean plane over an idealized point set equal in number and area to the actual set, and having been dispersed evenly throughout the extent area. Finally, a description of a working system utilizing the techniques developed for this thesis is given.

The impacts of this work will be a more statistically sound method of "hotspot" mapping for police departments. This should enable investigators, analysts, patrol officers, and administrators to share information with one another and with other jurisdictions. This sharing of knowledge will make law enforcement more informed, improving their success and efficiency and making cities, towns, and counties safer and more enjoyable.

***Advanced Spatial Techniques for Crime Analysis*, Arthur Getis.** Crime control has become a high priority area in the public mind and in public policy at all levels of government. Funding and advances in technology have allowed for the introduction of new methods for crime prevention, crime solution, and community-police interaction. The advanced technology includes fast and flexible computers and uses these to organize, store, manipulate, and analyze large sets of data, such as thousands of police reports. The technology allows for the charting and analysis of criminal activity, crime trends, unusual criminal patterns, and geographic depiction of spatial patterns of crime, including clusters of criminal activity.

Geographic Information Sciences (GIS) is a relatively new field that is only beginning to be of general use for crime control. Recently, there have been many success stories from police in such cities as New York, New Orleans, Baltimore, Philadelphia, and San Diego on the usefulness of crime mapping and GIS . The advancement of GIS and crime analysis owes much to software development at academic institutions, commercial firms, and in government agencies. Much of this software is designed to identify what are called "hot spots," which are areas of increased or unusual criminal activity. This research's review of these programs indicates that the hot spot identification procedures are too arbitrary and general for judicious allocation of police resources. For example, those that use ellipses to locate hot spots more often than not cover large areas in which only part should really be considered as a hot spot. Although the programs do locate areas of elevated criminal activity, the spatial demarcation of the areas is vague, not always statistically sound, and clearly in need of more specific identification. Because the cluster identification routines lack statistical validity, any confidence one might have in the maps must be limited.

The project has developed techniques to work around the problems mentioned above. Technically, the methods make use of both K-function analysis and local G and K statistics (statistical analysis developed by the presenter with J.K. Ord of Georgetown University). In essence, these statistics quickly assess the location of each criminal incident of a particular type, such as robbery, over a particular time period, say a two-week period, at ever increasing distances, evaluating along the way for statistically significant clustering. Primarily, the incidents that are identified as being members of clusters are mapped as such. Secondarily, a control, say robberies in the same two week period last year, are mapped and deviations noted and measured statistically. Positive deviations represent hot spots. The controls, matched on factors such as income, are taken from already existing historical crime data or data made available through the U.S. census. The in-house analysts make the actual selection of controls. A diverse set of users including analysts and managers can use the tools as investigative aids.

The software is designed so that it may be used widely within the San Diego Police Department and can be made available to other agencies as well. The code is developed within an ArcView environment using programming tools such as Avenue and Fortran. Once statistically significant clusters have been identified, state-of-the-art representations of the data are available for analysis.

Concurrent Breakouts, Monday, 3:30 p.m. – 5:00 p.m.

Hot Spot Methods: An Overview

***Hot Spot Analyses of Crime: Methods and Applications,* James Cameron and Spencer Chainey.** Recent advances in desktop GIS technologies and spatial analysis applications have significantly improved the ability of crime analysts to look more closely at the spatial patterns and locational contexts of crime. As a visualization tool, GIS can be used to integrate data from diverse sources into a single georeferenced database containing observations from neighboring locations. Spatial patterns can then be represented and visualized across locations, providing insight into potential spatial clustering, heterogeneity, and spread over time. As an exploratory data analysis tool, GIS spatial analysis applications can be used to examine data more rigorously, a way of generating new hypotheses from the data or identifying unexpected spatial patterns.

In the case of hotspot analyses of crime, a variety of different methods and techniques available in software packages can be used to help reveal the types of patterns that exist in crime data. These include methods that provide global statistics revealing general patterns in our crime data, and mapping techniques that visually describe hotspots and present opportunities for further analysis. With the increasing availability of a range of sophisticated tools for analyzing crime hotspots, very little guidance is offered as to which techniques are suitable for crime hotspots indicated by different types of data and different crime mapping applications.

This presentation will discuss and demonstrate the application of these methods and techniques on typical crime data. The approach will be very practical and will help to improve a crime analyst's understanding of the advantages and disadvantages of different methodologies for analyzing hotspots of crime.

Planning for GIS Acquisition: Case Studies

***Planning for GIS Acquisition,* Thomas McEwen and Maureen O'Connell.** Criminal justice agencies are faced with an ever-changing landscape in the field of information technology. This panel will discuss the challenges faced by law enforcement and other criminal justice agencies when going through the process of acquiring GIS technology, including different organizational constraints. The panel will provide attendees with an overview of the steps necessary to succeed when going through the acquisition process and will also provide resources and tools that the attendee can take home. The presenters will outline the four phases involved in the acquisition process: Assessment and Decision Making, Procurement, Implementation, and Impact Assessment, and will also outline critical success factors during each of the four phases. The intended audience for this panel includes crime analysts, law enforcement managers, and information technology personnel responsible for the acquisition of technology for their departments.

Interactive Web-Based Mapping Showcase

***MAPSTAT: Analytical Route to Success,* Jenni J. Gardner.** Working closely with investigations and patrol personnel in the field, analytical staff from Illinois State Police's Strategic Information and Analysis Group have designed an intranet mapping application, MAPSTAT, that provides users with the ability to query on crime, traffic, and demographic data by a specific geographic area. Various data layers of crime and demographic statistics can be viewed in map or table view. In the traffic component, users are able to conduct specific queries on fatal crashes or all crash types and view the results of their query in a visual map format. Also, enforcement data such as DUI's and "Fatal Five" citations can be viewed simultaneously against crash data in order to obtain a clearer picture of effectiveness.

MAPSTAT is a powerful MapObjects based GIS application that will meet the traffic and investigative reporting needs of field troopers and command level staff within the Illinois State Police. The application has been beta tested and will be available to all personnel in the fall of 2000.

Real Time Crime Reporting – The State of Delaware's Latest Tool in Fighting Crime, **Eric Swanson.** Governor Thomas R. Carper challenged the Delaware Department of Public Safety to develop a tool that would provide "Instantaneous, accessible information to assist law enforcement officers to identify crime, target specific hot-spots and to be on the alert for certain violent criminals." The Department of Public Safety was tasked with implementing this challenge. Enterprise Information Solutions was selected as part of a team to develop the new statewide Real Time Crime Reporting (RTCR) mapping website. The development of the RTCR system involved over 45 state and local agencies that include the Department of Public Safety, Delaware State Police (DSP), Delaware Criminal Justice Information System (DELJIS), State Bureau of Identification, Office of Information Services, Department of Transportation, and the police departments in Dover, Wilmington, New Castle County, and Newark.

The RTCR System displays maps indicating where reported crime has occurred, thus focusing on crime intervention through an analytical approach. In conjunction with the state-wide deployment of mobile data terminals and the Enhanced Police Complaint reporting system, the RTCR will graphically provide the location of criminal incidents within minutes of the electronic report being filed. The RTCR system, a web based mapping solution that can be accessed via a web browser, is as a state-wide law enforcement tool, without bias to individual agencies. With RTCR an agency can display not only criminal incidents within their jurisdiction, but also neighboring areas. There are three primary types of outputs from the RTCR system: creation of maps displaying crimes, tabular detailed report data, and exported RTCR System crime data. The data used in the RTCR system is broken into two categories, the criminal incident data and the mapping data. The criminal data is being supplied by the states CJIS database. As new reports are submitted to the CJIS system, triggers are fired that extract a subset of the complete report and send the data to the RTCR system for storage and geocoding. The mapping data was acquired from three different sources, Delaware Department of Transportation, Delaware Statistical Analysis Center, and GDT. The data from each of these sources was combined to provide the data layers requested by the agencies to be displayed on the maps: streets, county and municipal boundaries, police jurisdictions, churches, schools, hospitals, major landmarks, etc.

Intranet Crime Mapping Using ArcExplorer, **Karen L. Vincent.** ArcExplorer is a cost-effective means to bring Intranet mapping to a police agency. Five items are necessary to be successful: a data warehouse, connections to the warehouse, ArcExplorer on every PC, a training program, and effective marketing. Details of implementation are discussed as well as a summary of pitfalls and how we addressed them. Attendees will leave with all information necessary to implement ArcExplorer in their own agency or organization.

Successful Case Studies: II

Study on Distance Youth Travel to Commit Crimes, **Susan C. Wernicke**. Just how far will our youth travel to commit crimes? Does obtaining a driver's license have an impact on either or both of these scenarios? Based on crime data from January 1, 2000 to March 31, 2000 in Overland Park, Kansas, juveniles (ages 11-17) will be examined to determine, by age, the average distance traveled to commit a crime and the seriousness of the crime they commit. Using ArcView functions, the distance traveled to commit crimes (from home to arrest location) can be determined. The seriousness of the crime is examined and, based on Kansas state statutes, can be evaluated to determine the severity of the crime.

***Tracking Repeat Burglary,* Erick E. Barnes.** Although a host of research has been conducted on groups of repetitive property offenders, their careers, and their ultimate cessation, little direct attention has been given to an issue central to them and their marginal existence, social class. Currently, the Detroit Police Department utilizes an ArcExplorer based mapping system to monitor crimes throughout the city of Detroit. Access to the mapping system is provided department wide, which allows officers as well as supervisors the ability to view crime patterns and access crime data. However, because of the shear number of property crimes on a daily, weekly, and monthly basis, patterns are not easily discernable.

The purpose of this project is to study the patterns of career burglars in Detroit and ascertain some commonalties and occurrences. Primarily, it is concerned with applying a distance decay and journey-to-crime theories to their patterns. The premise is that career burglars are criminals of habit and have identifiable patterns by which they operate. The study is interested in the frequency, severity (monetary), and frame of the burglars as they move further from their home base. From this information, we hope to identify the patterns of career burglars and be able to develop a system by which career burglars can be distinguished from opportunistic burglars.

Beyond this fundamental yet overlooked background variable, the study must also focus on concepts such as offender mobility and distance decay phenomena.

***Success in Analyzing a Burglary Trend,* Jacqueline L. McClanahan**. The Mesa Police Department began experiencing a rash of residential burglaries in one police beat during the month of October 1999. Ms. McClanahan performed tactical analysis procedures on the incidents and used the gathered information to produce a Crime Trend Bulletin. This bulletin was distributed to patrol, detectives and the command staff. The bulletin stated the MO of the suspects, descriptions, date and times they were hitting, and a table of the incidents. It also included a map showing the burglary sites and an elliptical circle showing the area where they were most likely to hit again. This gave officers and detectives an area in which to concentrate their efforts. The area was worked intensely for a few weeks. Extra patrol was used, surveillance was conducted, and the crime scenes were thoroughly processed. The results were six arrests and the number of burglaries dropped from a high of 30 in November to just 10 in December.

Research Applications with GIS

***Natural Experiments in Generation and Reduction of Street Robbery: Analysis of Rapid Transit Station Changes in Chicago,* Richard Block.** Over the past ten years in Chicago elevated stations and lines have opened and closed and sometimes reopened again. This presentation combines information on every street robbery occurring in Chicago from 1991 thru 1999 with a chronology of these openings and closing. These transit system changes will be analyzed as natural experiments in environmental manipulation using time series analysis and spatial demonstrations of change over time.

Earlier research in the Bronx and Chicago has shown that street robbery hot spots frequently occur in the area surrounding rapid transit stations and that the frequency of street robberies increases rapidly to a peak about 1.5 blocks from the station. In Chicago, this research has resulted in a reallocation of police units away from the el stations to the nearby areas of greater risk exposure.

The research presented here moves from static comparisons of distance to analysis of change over time. Between 1991 and 1999, a new transit line was opened in Chicago, an old line was closed and then reopened, and several stations were either permanently or temporarily shut down. Did these environmental changes affect levels or dispersion of street robbery in the surrounding neighborhoods? Comparisons over time and between stations on the same line create natural experiment tests of the effect of proximity to a rapid transit station on risk of street crime.

***Using CrimeStat and GIS for Analyzing Spatial Dynamics of Drug Complaints and Arrests,* James L. LeBeau.** The pioneering DMAP project demonstrated how viewing street level drug activity geographically can provide valuable insights for guiding policies, strategies, and tactics. During the relatively short time from the release of the initial findings of DMAP, the tools and methodologies for spatially describing, and analyzing crime in general and drug incidents, in particular, have increased dramatically and become more accessible to a variety users.

Employing ArcView and CrimeStat, this research is concerned with describing, measuring, analyzing, and visualizing the spatial dynamics of drug arrests (N= 15,817) and complaints (N=5406) in Charlotte-Mecklenburg, North Carolina from 1997-1999. Applying CrimeStat's analytic tools and ArcView's visualization capabilities to three years of street block address data (point shapes) allows one to do two things. First, analysts can assess how drug arrest and complaint hot spots emerge, persist, displace, and recycle. The latter property occurs when a hot spot is cooled off, but later flares up with more activity. Second, the arrest data have the address of the arrest as well as the home address of the offender; therefore, it is possible to examine the commuting patterns of drug offenders from their residences to the places of their arrests.

Strong emphasis in this presentation is placed on how the maps and techniques are interrelated. For example, general or global patterns assessed visually from the point maps can be measured and confirmed with nearest neighbor analysis and Ripley's K. The data are from the Charlotte-Mecklenburg, North Carolina, Police Department, covering individual incidents for drug arrests and complaints from 1997 to 1999.

***Assessing Spatial Characteristics of Juvenile Homicide Offending: Exploratory Analysis of Juvenile Homicide Offending in Houston, 1986-1994,* Derek J. Paulsen.** Although the study of juvenile violence has a long tradition in criminology, there has been increasing interest in this topic due to the rise in juvenile homicide in the late 1980s and early 1990s. While much research has focused on the influence of gangs, drugs, and guns as explanations for this increase, little is known about the spatial aspects of juvenile homicide, particularly temporal changes in spatial distribution. This study profiles the spatial distribution of juvenile homicide in one of the nation's largest cities, Houston, Texas, during the peak period of juvenile homicide 1986-1994. Specifically, this research seeks to determine spatial differences between juvenile and adult homicide offending, disaggregated juvenile offense types, longitudinal changes, and the utility of social disorganization in explaining the variance in juvenile homicide at the neighborhood level. The authors find important differences in the spatial distribution of adult and juvenile homicide locations as well as longitudinal differences in the spatial distribution of juvenile offending. Moreover, spatial differences are also identified for gang and drug-related homicides. Finally, important differences are found in the utility of social disorganizational variables to explain the variance in adult and juvenile homicide offending at the neighborhood level. The authors conclude with a discussion of implications of the research.

Mapping Out Drugs: Case Studies

***Examining Strengths and Weaknesses of Repeat Address Mapping as a Crime Analysis Tool,* Jeffrey S. Gersh.** For most police applications, the mapping technique of choice continues to be the plotting of crime sites on a single base map. Computers have made this less labor intensive and more flexible than it has been in the past, but these are still spot maps. While the reasons for their continued utility are many, they still have several basic weaknesses. One of the most glaring is that, when examining crime trends from a long period of time on a small scale map, the clusters of spots blend into a single cloud of crime. This technique results in an excess of map clutter and increases the difficulty of interpreting the underlying pattern of events, which ultimately makes it problematic to law

enforcement officials to make tactical and operational decisions. In this paper, researchers describe a simple technique, Repeat Address Mapping, that can be used to identify high crime areas of repeat activity. Presenters examine data from two separate jurisdictions (Baltimore City and Washington, D.C.) and explore the strengths and weaknesses of this techniques as it pertains to different types of crime events.

***Illinois Statewide Methamphetamine Risk Model*, Boyd Butler.** Methamphetamine continues to be a major threat to public safety in Illinois. The number of reported labs seized rose 950 percent over the last three years, from 24 labs in 1997 to 246 labs in 1999. The dangers affiliated with this epidemic affect the public, law enforcement, legislators, medical professionals, families, children, and the environment.

In an attempt to stay ahead of the epidemic, a Methamphetamine Risk Model was created to identify current as well as *potential* "hot spots" in the state that could be at risk for methamphetamine problems. By integrating known characteristics of methamphetamine users and Illinois county demographics into a geographical model using ArcView Spatial Analyst, high risk areas that have characteristics conducive to methamphetamine use and manufacture can be identified. The risk-model serves as a strategic tool that assists law enforcement personnel and communities in forming proactive rather than reactive strategies to combat the effects of this drug.

Data on methamphetamine encounters and people seeking treatment can capture the characteristics of users and geographical characteristics of illegal methamphetamine production. Nine factors were gleaned from the data: age, gender, race, marital status, income, and rural or urban nature of the counties.

For each factor, a grid coverage was generated, classified and scored based upon the prevalence of each of the selected factors. Once scored, Spatial Analyst was used to add all grid factors together. The resulting grid was reclassified into nine groups and categorized as high, medium, and low risk areas. The highest scoring areas represent potential "hot spots" that show the most prevalent characteristics for methamphetamine activity.

***Action Oriented Mapping: In Support of Drug Interdiction*, Tom Hayden.** Arizona is a major arrival and trans-shipment location along the Southwest Border for illegal drugs destined for other regions throughout the United States. Arizona's 370-mile border with Mexico consists of sparsely populated areas, vast expanses of rugged mountains aligned in north-south corridors, broad valleys, and desert, all of which provide major opportunities for drug-smuggling activities.

The Arizona High Intensity Drug Trafficking Area (AZ HIDTA) is one of the five HIDTAs located along the Southwest Border of the United States and is a co-leader in the Southwest Border COBIJA (Spanish for blanket) Operations, which are conducted several times a year. Successful coordinated joint drug interdiction operations require trends, patterns, and predictive intelligence. Besides delivering traditional intelligence support to law enforcement investigative cases, the AZ HIDTA Intelligence Support Center (ISC) uses GIS mapping as the principle analytical tool. The foundation to this analytical process consists of source collection management, developing essential elements of information and intelligence, and standardized seizure/incident reports from many different drug task forces or agencies.

Intelligence support for COBIJA has three phases: planning, operations, and after-action review. The following four areas are analyzed in each phase.

- Arrival Zone — that area where drugs first enter the United States.
- FADES — aircraft suspected of transporting drugs that are detected in Mexico heading north toward the US Border.
- Highways — what highways are most often used, where, when and in what direction of travel.
- Vehicles — trends in type of vehicles, registration state, etc.

Concurrent Breakouts, Tuesday, 8:30 a.m. – 10:00 a.m.

Creating the Tools: New Approaches to Crime Mapping

Prototype Exploratory Spatial Data Analysis Application for Crime Analysis, **Ronald E. Wilson.** Throughout the development of GIS there has been a desire for GIS software that contains tools for interactive statistical analysis, that is, analysis that also allows the linking and display of spatial data plotted on maps with corresponding attribute data on a graph (known as exploratory spatial data analysis, ESDA). A key benefit of these tools is that they allow for efficient and dynamic examination of the large amounts of data often compiled today. When data of this magnitude is compiled, it becomes exceedingly difficult for the human eye to find meaningful relationships in the data sets. A further benefit of the software is the ability to simultaneously visualize spatial and attribute data.

Advancements have been made in this area, particularly in stand-alone statistical software; but there is still a demand for spatial applications that provide the opportunity to visually explore, simultaneously view and statistically analyze spatial and attribute data.

The need for this type of analysis appeared during the development of the Regional Crime Analysis Geographic Information System (RCAGIS) by the U.S. Department of Justice Criminal Division GIS staff. Originally, the command staff of the Baltimore County Police wanted to view movement of crime incidents in a given area. The Crime Analysis Unit originally took "snapshots" of individual thematic maps with different values and placed them into MS PowerPoint as individual slides. Visualization/animation was accomplished by running through the slide presentation one map at a time to show the incident movement. However, this method requires much effort to make the maps, capture "snapshots" of the maps, place these into another application, and then display them dynamically. Many software applications may be required: a mapping application, a statistical application, a screen capturing and editing application, and a presentation application. Further, the method moves away from linking GIS to statistics, by removing the investigative and analytical capabilities of the GIS and statistical softwares. The map cannot be queried for information, nor can the most basic descriptive statistics be derived. Interactivity is also completely removed.

To help the Baltimore County Police Department Crime Analysis Unit and the RCAS Group take advantage of their database structure, an exploratory tool was introduced into RCAGIS. The exploratory tool allows for viewing crime incident data by displaying the observations on a graph and a map simultaneously and permits limited interactivity. Given that the RCAS data was of nominal and ordinal nature, no methods were developed to examine dependant and independent variables of the observations. Rather, focus was shifted to developing exploratory methods that allowed for the viewing of observation frequency, attributes and positions while interactively synchronizing a graph display with a map display.

The ESDA tools developed for RCAGIS were specific and minimal, but led to other ideas that would enhance RCAGIS. This prototype was based on development experience for RCAGIS, and the intent is to share the knowledge and possibilities with other crime analysts to avoid cumbersome and ad-hoc methods. The presentation demonstrates the visualization and interactive methods and gives particular attention to Microsoft Visual Basic (VB), Environmental Systems Research Institute's (ESRI) MapObjects, and a prototype technology called StatObjects (SO). The presenters hope that other law enforcement agencies can take this knowledge and effectively develop their own ESDA tools with minimal effort.

Aoristic Analysis: Mapping Micro-Level Temporal Change in Crime Patterns, **Jerry Ratcliffe.** Crime analysis and environmental criminology have tended to focus on the "where" of crime, but less on the "when." The identification of areas with higher densities of criminal activity (hotspots) is an important aspect of understanding patterns of offending, but these patterns can change over the

course of time and even within a few hours. The problem with recorded crime data is that the exact time of offence is rarely known, and police databases are left to record a start date and time and an end date and time. The gap between the two can cause great difficulties for crime analysts, however this presentation offers a solution that not only allows for a clearer understanding of the temporal dynamics of crime events that are temporally indeterminate, but also permits the mapping of these shifting hotspots. The technique, termed aoristic analysis, is demonstrated using animation techniques and police data from the UK and Australia.

CrimeStat 1.1: An Overview

CrimeStat 1.1: Spatial Statistics Program for the Analysis of Crime Incident Locations, **James L. LeBeau for Ned Levine.** This session will demonstrate the *CrimeStat* spatial statistics program developed for the Crime Mapping Research Center of the National Institute of Justice by Ned Levine & Associates. This is a stand-alone windows program that interfaces with most desktop GIS packages including ArcView, Atlas GIS, MapInfo, Surfer for Windows, and ArcView Spatial Analyst. This package with documentation and sample datasets is available from (http:// www.icpsr.umich.edu/NACJD/crimestat.html).

Understanding Victimization

Analysis of Firearm-Related Victimizations in Public Housing Communities with GIS, **John G. Hayes and Donald B. Ludlow.** The U.S. Department of Housing and Urban Development's March 2000 report, "In the Crossfire: The Impact of Gun Violence on Public Housing Communities," has unleashed a barrage of criticism for the findings that 'persons residing in public housing are over twice as likely to suffer from firearm-related victimizations as other members of the population. Because the conclusions were based on data from the National Crime Victimization Survey, data regarding crime in public housing that have been since drawn into question (only 229 of the 15,563 persons sampled lived in public housing). While this study does not provide a perfect national analysis, maps offenses involving weapons over a period from 1994 through 1999 using a sample of municipalities and housing authorities ranging in population from very small to very large (Washington, D.C.; Montgomery County, MD; Charlotte, NC; San Antonio, TX; Rockford, IL; New Bedford, MA; and Brockton, MA. The research differentiates between incidents happening in and around public housing developments and the rest of the city, to determine to what degree public housing residents are victimized in firearm-related incidents.

The findings combine a variety of data, including crime locations, public housing development boundaries, Section 8 recipient addresses, municipal boundaries, and demographic variables from the U.S. Census and local sources. Specifically, this analysis finds that public housing residents and those living close to public housing are disproportionately victimized in firearm-related crimes, such as assaults with deadly weapons. The hypotheses were tested using buffer analysis, polygon selection, and other GIS query methods.

Retrofitting Context and Integrating Spatial Models: A Re-Look at Contextual Effects in a Study of Victimization in Seattle, **Karen L. Hayslett-McCall, Stephen A. Matthews, R. Maureen C. Outlaw, and Barry Ruback.** This research paper focuses on the application of Geographic Information System (GIS) technologies, spatial statistics, and hierarchical linear modeling to retrofit and reanalyze data from a 1990 Seattle victimization study. "The primary objective of [the original] study was to test criminal opportunity theories of victimization and the collective benefits or harm resulting from citizen-based crime control activities" (Miethe, 1998). In this

paper, researchers extend the work of Miethe and colleagues both conceptually and methodologically. The goals have been to think creatively about how GIS can be used in crime research, stretch the GIS technology, and revise the methodologies currently used in crime analysis.

The project develops a unique contextual (neighborhood) level data set incorporating information from numerous sources (including among others, the King County Metro Planner's Office, the Seattle PD, telephone directories, and selected maps and atlases). In addition to demonstrating "value added" through GIS data integration, presenters provide an application that explicitly incorporates spatial structure in the project database and thereby facilitates an analytical strategy that includes the possibility of spatial models. Thus, the spatial patterning and linkage structure between all census tracts in Seattle is embedded within the geographic database allowing the calibration of spatial regression models using SpaceStat, S-plus, and CrimeStat interfaces to ArcView. The results include OLS and logistic regression models, comparisons to spatial regression models (the latter allowing investigation of the significance of spatial dependence or clustering in the models), and multi-level models (using HLM). This type of true spatial analysis is still relatively rare in the literature on crime analysis. The paper concludes by stressing the importance of incorporating spatial structure in models and for stretching the GIS technology and revising current methodologies in crime analysis in general.

Extending Findings from Repeat Victimization: Understanding the Nexus, **Deborah Lamm Weisel and Don Faggiani.** Studies of crime have shown that crime clusters in geographic areas known as hot spots and on specific places and people within those clusters. These hot dots in hot spots reflect the piling up of crime on people and places. Known as repeat victimization, the "hot dot" phenomenon is an important and pervasive criminological phenomenon which can be targeted to reduce crime.

Little is known about the incidence, concentration, and variations of repeat victimization and its relationship to crime hot spots. The research study presents findings about the incidence and concentration of repeat victimization, featuring a method to identify repeat victimization through police offense data, by standardizing definitions, time frames, and area-level variables.

Repeat victimization for four types of crime were examined in this study: commercial robbery, commercial and residential burglary, and street robbery (in four jurisdictions: Austin, TX; Miami, FL; Montgomery County, MD; and Indianapolis, IN). These crimes were analyzed using police offense reports supplemented by police dispatch records, property tax, and census information. Analytic procedures consisted of address-matching; all addresses are geocoded and maps are used to present findings about the incidence of repeat victimization, its relationship to hot spots of crime, and to illuminate the overall spatial distribution of crime and repeats by crime type. By use of scaled icons, the maps illuminate the concentration of repeat victimization. By examining differing types of crimes, the study illuminates the different challenges, defining offense locations related to victimization. The study thus expands the corpus of knowledge on repeat victimization, established primarily in Great Britain and Australia, and substantially extends knowledge about the incidence and concentration of repeat victimization of different crimes in diverse places. It provides baseline information on the phenomenon in America and potential for the development of effective responses.

Tracking Firearms for Prevention and Intervention

Firearm Analysis System: Collaborative Efforts in Philadelphia, **Katrina Baum.** Collaborative efforts have been underway in Philadelphia for over two years to design a Firearms Analysis System that will enhance problem-solving efforts related to gun incidents. Data for this application is housed on a server at the Philadelphia Police Department (PPD), which is available to detectives and command-level staff who can perform intelligence tasks on a browser-based platform. This application streamlines the former paper-driven and labor intensive process to execute a trace on a

firearm, and it has resulted in more timely and accurate data at the disposal of PPD detectives and Philadelphia ATF agents. Functionality of this intranet system includes charting, mapping, reporting, and searching. In addition to identifying the steps necessary to create such a system, the presentation will also discuss impediments to implementing this type of system involving multiple agencies and how they were overcome.

Distance, Time, and Crime: Using ATF's Law Enforcement and Regulatory Data to Trace Firearms Trafficking Patterns, **John R. Freeman**. The Bureau of Alcohol, Tobacco, and Firearms (ATF) is the agency primarily responsible for enforcing Federal firearms laws, and for tracing the origins recovered by law enforcement agencies in the course of their criminal investigations. Each year ATF traces thousands of recovered crime guns from manufacturers to retail firearms dealers and on to their retail purchasers. Analysis of this firearms trace data, especially of guns that moved quickly from legitimate commerce to recovery in a criminal investigation, often allows us to detect patterns of illicit firearms trafficking. This presentation will report basic spatial and temporal patterns formed by linking firearms purchases to crime gun recoveries in the tracing process. We will go on to present more refined measures of distance, and to discuss social factors that influence the effect of distance on firearms trafficking.

Mapping Across Boundaries: Multi-Agency Applications

Cross Jurisdictional Crime Mapping and Analysis in New York State, **William H. Hogencamp.** In New York State, a criminal justice initiative of Governor Pataki's was to create a highly effective and easily accessible crime mapping system for law enforcement agencies. The system uses the full force of today's technology against criminals, providing a cross-jurisdictional mapping system to effectively reduce crime and improve public safety.

The completed crime mapping system utilizes web-based technology with access via a secure intranet, available only to approved criminal justice agencies. The database is populated by extracted files created by local law enforcement records management systems and employs a custom developed mapping application residing in a secure environment at the Division of Criminal Justice Services (DCJS).

Records management systems of the local law enforcement agencies participating in the pilot create an extract file of incident and arrest data. At DCJS, the data is compiled, maintained and blended with other agencies' information to provide cross-jurisdictional data, which is then integrated with the crime mapping software. Finally, the local law enforcement agency has access to this cross-jurisdictional data by accessing the application via the DCJS Secure Services Intra-net.

Recognizing that the concept is evolutionary in nature, efforts to enhance the system might include adding additional mapping data, such as location of the homes of probationers and parolees, as well as, high profile addresses. The concept of cross-jurisdictional mapping, when proven effective, is replicable throughout New York State and possibly throughout the country.

Logical Spatial Units — Methodology for Sharing Police Data with External Agencies, **Ian Oldfield.** In 1998, the UK Government introduced the Crime and Disorder Act, mandating police authorities to share crime and incident data with non-police agencies, such as local government and social welfare agencies, the intention being to tackle crime and disorder through mulit-agency partnerships. Existing legislation protecting personal privacy was to remain largely intact, thus shared data had to be de-personalized.

A methodology was required to fulfil the mandate and maintain personal privacy while embracing the spirit of the new law. Trust would be built over time, but the deadline on audits dictated

that data be shared without undue delay.

The author developed the concept of Logical Spatial Units (LSU's), whereby the aggregation of data could be articulated in areal units that were meaningful and useful to external agencies and operational police units alike. Shared data prior to this model were based on either grids, large administrative areas, or postal deliver units, none of which fully satisfied agencies or police. LSU's are based on groupings of buildings or land and are split by their natural or physical boundaries, i.e., road intersections, open spaces, railway lines, or building perimeters. The aggregation is based around the local topography but in a human dimension.

A pilot is underway in the London Borough of Lambeth to develop and test the methodology. The initial results of this are encouraging and have received continued and renewed support. The presentation will discuss the background to the methodology, the implementation and issues affecting the pilot, including the creation and labeling of LSU's, and the alternatives, the lessons learned and conclusions reached thus far.

Greater Newark Violence Prevention Project: Applications of Mapping in a Multi-Agency Collaboration, **Erika Poulsen**. The Greater Newark Violence Prevention Project (GNVPP) is seeking to develop and implement a collaborative problem-solving process to address violence and its community-wide effects in the metropolitan area. The project's strategy includes: (1) marshalling and concentrating all available community resources: criminal justice, government, business, service, and faith; (2) developing a partnership that includes citizens; and (3) initiating a process through which problems can be addressed effectively in the future and an improved quality of life achieved and sustained. By all accounts, the first few steps have produced significant achievements and created expectations for greater results to follow. This presentation is a case study of the GNVPP and the criminal justice agencies involved. Specifically, it will detail the vital role GIS has played in the problem-solving process.

Predictive Modeling: Findings From Five Studies: Part I

Examining the "Broken Windows Thesis" of Crime: Technical Aspects, **Samuel H. Field.** This presentation, discusses and demonstrates a variety of statistical techniques applicable to the analysis of spatially and temporally referenced crime data. Particular emphasis is placed on the application of these methods to the problem of generating both useful and accurate summaries of space-time crime data in the interest of helping researchers make inferences about any underlying processes and/or relationships identified in the data. First, the presentation discusses a spatial version of exploratory factor analysis and applies it to the problem of examining the multivariate spatial structure of diverse crime types using an example data set. Mr. Field then discusses the potential benefits of thinking about crime data in a hierarchical generalized linear modeling framework. In particular, he demonstrates how mapping the different sources of variation identified in these models can help researchers uncover potentially important patterns in their data. I also demonstrate how the flexibility of these models can improve estimation of spatial and temporal dependence in the presence of non-normal error variance. And finally, the discussion concludes by briefly discussing some more advanced applications of these models as well as some problems encountered while attempting to implement them.

Geographic Analysis of Illegal Drug Sales in Wilmington, Delaware, **George F. Rengert.** This presentation is an analysis of illegal drug sales in Wilmington, Delaware. Concepts from marketing geography are used to predict where sales are likely to be located using measures of local demand and accessibility to regional customers. Features of the built environment that are likely to generate customers for illegal drugs such as schools, taverns, homeless shelters, drug treatment centers,

check cashing stores, major highways, public transit centers, and thoroughfares are identified. The Geographic Information System (GIS) then maps the locations of these facilities and the spatial arrangement of local demand to determine the relevance of each to illegal drug sales. The presentation concludes with policy issues identified in the analysis.

Detection and Monitoring of Geographic Patterns in Crime Data, **Peter A. Rogerson.** This presentation will focus upon two statistical aspects associated with the interpretation of data on crime locations. First, new methods will be introduced to assess the statistical significance of clusters of crime. These new methods represent an extension of current methods that are more exploratory and visual in nature. They are adapted from their original use in brain scan imaging, where the objective is to detect regions of increased blood flow. The second part of the presentation will focus on monitoring methods, where the objective is to detect, as quickly as possible, any new changes in the underlying geographic pattern of crime. This approach to the monitoring of possible changes in the spatial pattern of crime is based upon similar ideas used in quality control for industrial production. The two novel approaches to crime analysis will be illustrated using data from the Buffalo Police Department.

Concurrent Breakouts, Tuesday, 10:30 a.m. – 12:00 p.m.

Drug Interdiction with GIS

Mississippi Counterdrug Enforcement Decision Support System (MCEDSS) – A GIS-Enhanced Rule-based Expert System, **Glen Carpenter, Paul Crocker, and Jim Matthews.** The Mississippi Counterdrug Enforcement Decision Support System (MCEDSS) will provide law enforcement agencies with a tool to support them in marijuana detection and eradication operations. The system integrates a GIS and rule-based expert system to provide cueing to areas with a high likelihood of containing outdoor-grown marijuana. The rules of the system are derived from interviews with experts and are encoded into a robust inference engine that combines GIS spatial analysis with intelligent, automated processing. The cueing information will be available in both hardcopy and digital formats. The system is currently being designed and built.

Counterdrug GIS Training (CD-GIST): Focused Interagency Collaboration to Provide No-Cost GIS Training to Law Enforcement, **Stephen R. Gingrich and Billy Asbell.** The Counterdrug Geographical Information Systems Training (CD-GIST) program focuses on training the Counterdrug Law Enforcement Agent (DLEA) on the need and use of GIS principles and applications software. Prior to the deployment of the Counterdrug Geographical Regional Assessment Sensor System (CD-GRASS), which will be GIS based and rely heavily on GIS technologies, the National Guard Bureau (NGB) is initiating the CD-GIST program to help train law enforcement agents (LEAs) in the purpose and use of GIS to support their missions. This will assist in the operational delivery of CD-GRASS and provide higher levels of GIS experience in the law enforcement community.

Through the collaborative efforts of the Federal Law Enforcement Training Center (FLETC), The Carolina Institute for Community Policing (CICP), ESRI, The Naval Air Warfare Center, the four National Guard Bureau (NGB) schools, and the National Guard Bureau Environmental Programs Division (NGB-ARE) GIS training capabilities, DLEAs will learn how GIS can assist them in their mission. The DLEA will also learn how to use the most common commercially available GIS software. With support from the DOJ/NIJ Crime Mapping Research Center (CMRC), this program is destined to change historical documentation, investigations, and operations.

The Northeast Counterdrug Training Center (NCTC) has taken the lead for the National Guard in this area by establishing the Geographic Information System Learning Center as part of their training

facility in Annville, Pennsylvania. This initiative is composed of a three-phase project for DLEAs, using GIS training. The proposed training is based on the hypothesis that, if disadvantaged law enforcement agencies were given laptops equipped with GIS (and the necessary training) to begin communicating and sharing drug-related data, the drug trafficking and related crime in these areas would decrease by ten percent in three years.

In Phase I, NCTC will purchase 125 laptops, GIS equipped, to give to one student from each of the five targeted participating law enforcement agencies in Pennsylvania, New York, New Jersey, Maryland, and the District of Columbia. Agencies within these five target areas, with sworn personnel less than 250 and more than 50, will be offered first choice of GIS courses and will receive a laptop upon the successful completion of the following:

- ? Introduction to GIS (non-technical),
- ? Introduction to GIS (technical),
- ? Signed agreement with NCTC about the use of the laptop,
- ? Signed agreement with NCTC regarding the future use of the laptop, and a
- ? Signed agreement with NCTC stating the future funding available to continue a GIS for that agency.

Once an agency has received the laptop, it will have one year to learn the GIS capabilities and share their knowledge with other participating agencies. The agency will need to obtain the necessary data layers from other state agencies, working with the other five identified states to exchange information, share drug trafficking patterns, and participate in community problem solving initiatives. At six months and 12 months, the NCTC, CICP, and ESRI will evaluate the program. On the 13th month (if successful to that point), the NCTC will increase network to include agencies with fewer than 50 sworn employees (Phase II). By doing so, the NCTC will effectively begin educating all agencies within the five target areas.

During the second phase, working with agencies with fewer than 50 sworn employees, NCTC may have to offer more intense training to bring those agencies (possibly technologically deficient) up to speed. They will receive 125 laptops and the same introductions and agreements as the original group received.

In the second year of funding, those agencies participating in the project from the first 12 months will receive Intermediate GIS training while the smaller agencies entering the project receive introductory GIS training. At 18 and 24 months, the NCTC will evaluate Phases I and II of the program. Once the program is established and proven successful, NCTC will increase the target areas to include 18 states and the District of Columbia.

On the 25th month, GISIN expands to include law enforcement agencies with greater than 250 sworn employees, but these departments will not receive computers. They will, however, be able to receive GIS training and access to the GISIN. After the third year, it is anticipated that the GISIN, among the five target areas, will be effectively communicating and sharing information through the use of GIS.

The NCTC will begin to offer advanced courses to the mid-size agencies from Phase I, Intermediate courses to the smaller law enforcement agencies (Phase II), and also basic GIS courses (if there are a significant number of agencies that were unable to participate in the first two phases). The ultimate goal of this project is to create an information-sharing network, using GIS, among all law enforcement agencies in the Northeast.

CD-GRASS Program: Interagency Collaboration Focused to Support Counterdrug Law Enforcement in GIS Technologies, **Melinda K. Higgins.** The National Guard Bureau Counter Drug Office (NGB-CD), through the Counterdrug Geographical Regional Assessment Sensor System (CD-GRASS) program, is incorporating an innovative blend of GIS, digital mapping, enhanced

visualization, virtual reality, electro-optics, sensor fusion, modeling and simulation, data acquisition, and other operational assessment technologies. The mission of CD-GRASS is information (I) integration, assessment (A), and decision support to counterdrug operations (O) through state-of-the-art technology transfer and insertion. CD-GRASS also incorporates NGB-CD assets including their Digital Mapping Initiative (DMI), aerial reconnaissance and sensor deployment, law enforcement training centers, and 54 state and territory counterdrug task forces.

CD-GRASS is addressing these IAO requirements through three inter-networked programs:

- Database for Assessment of Requirements and Tactics (DART)
- Decision Support System (DSS)
- a Digital Mapping Server (DMS)

Prior to the deployment of CD-GRASS a clear understanding of the current law enforcement agency (LEA) information technology (IT) infrastructure, interface, and architecture must be documented nationwide. This task requires a GIS interface to document localities and spatially represent the information. To accomplish this task, DART will provide a GIS based tool for enhanced out-year and current year operational planning at the state level. It will provide an electronic capability to quickly visualize asset deployment while enhancing operational impact.

The NGB-CD has funded the Center of Higher Learning (CHL) located at Stennis Space Center, Mississippi, to design, build, and test the Mississippi Counterdrug Enforcement Decision Support System. The goal of the DSS is to increase the efficiency of marijuana eradication operations. The Georgia Tech Research Institute is also under contract to help adapt and deploy the system to the other states and territories within the U.S. The ultimate users will be the state LEAs and National Guard Counterdrug personnel. One of the fundamental problems in eradication of marijuana is the size of the search areas relative to law enforcement resources. The heart of the DSS will be a rule-based expert system module that produces cues to areas with a high potential for marijuana cultivation.

To meet data requirements for the GIS environment, NGB-CD has initiated the DMS. This server is intended to conform to the National Spatial Data Infrastructure (NSDI) standards overseen by the Federal Geographic Data Committee (FGDC). The virtual directional system will attract and route GIS data across the country, providing access to collaborators. All levels of government will be allowed access to GIS data from verifiable sources by simply querying the DMS over the Internet.

Exploring the Role of Remote Sensing in Law Enforcement

Using GIS and Digital Aerial Photography to Assist in the Conviction of a Serial Killer, **Antony K. Cooper, Peter Schmitz, P. Byleveld, and D.K. Rossmo.** A desktop geographical information system (GIS) was used to pin-map the 86 cases associated with the Wemmerpan serial killer, representing crimes committed between 17 September 1995 and 19 December 1997 in central, western and southern Johannesburg, South Africa. The crimes ranged from murder and rape to assault with intent to cause grievous bodily harm. A series of maps were produced, using either digital street-map data or ortho-corrected digital aerial photographs as the backdrop.

The photographs were particularly useful for incidents that occurred around Wemmerpan itself, a popular recreational area consisting of a dam (Wemmerpan) surrounded by picnic areas, a small forest, open ground, mine dumps, footpaths and other geographical features not normally found on a street map. The maps were used in court to show the geographical extent of the serial killer's activity space and to help the court understand the sequence of events as shown by evidence. Historically, photographs of a wall map bedecked with stickers have been used in such cases, but they have proved to be unsatisfactory. The digital maps are much more flexible, versatile, and easier to use.

Three-Dimensional Enhancements to Crime Mapping Using ArcView GIS, **Kenneth M. Johnson.** Demonstration of the uses of three-dimensional graphics to enhance presentations in law enforcement and crime analysis is the goal of this presentation. With the ArcView platform, the 3D Analyst Extension provides a means to create 3D imagery in a GIS which has a large user base in the law enforcement community. This talk will concern only that product.

The initial discussion will concern the portrayal of demographic data in conjunction with maps of crime activity. Caveats concerning the meaning of the displays will be included. Other areas of application concern the integration of orthophotography and building floor plans with the 3D Analyst views. Potential for use with search procedures in varied terrain will be discussed. Viewshed analysis as applied to 3D GIS in both urban and rural environments will be demonstrated.

A final section of this presentation will be discuss how the "flythrough" capability of ArcView or ARC/INFO may be used. Included in the presentation will be the author's criticisms of the 3D Analyst software and suggestions for improvements in that product.

Exploring the Role of Remote Sensing and Crime, **John R. Weeks, John Kaiser, Dongmei Chen, Milan Mueller, and Tim Dolan.** This project explores the usefulness of integrating remotely sensed images into the Crime View software developed by the Omega Group. Remotely sensed images potentially offer a very useful backdrop to street maps for officers with GIS capabilities networked to laptop computers in their car. More analytically, the classification of remotely sensed images provides a new set of variables that can be combined with demographic data, parcel data, and other sources of information to improve the identification of crime "hot spots" and to model the propensity for crime in a given area. Wthe research also examined the use of imagery to measure nighttime illumination in relation to crime events.

Improving Crime Pattern Detection with Theory

Street Patterns and Crime Patterns, **Lin Liu and John E. Eck.** A crime map typically shows the location of each crime incidence by using a graphic symbol. When some of the crime incidences are concentrated in a small neighborhood, this cluster of crimes (often called a hot spot) form a crime pattern. (It is debatable how small the neighborhood should be, thus the issue of scale is important in crime mapping.) The hot spots can be identified by visual inspection if graphic symbols do not overlay, i.e. each symbol represents only one crime incidence. In reality, it is very likely that multiple incidences occur in the same location. In this case, visual inspection will most likely fail to detect the correct patterns. Thus, computerized clustering algorithms are needed to reveal the patterns. Typical clustering software identifies the center of a hot spot, and draws standard deviation ellipse(s) around the center. Locations along the ellipse(s) are assumed to have the same probability of crime incidence. However, these algorithms assume that crimes are independent of the geographic environment. As a result, the crime patterns suggested by the ellipse(s) may be contradictory to crime theories.

There are two types of illicit markets. One is called a routine activity markets, which involve exchange among people who do not know each other. The other is called network markets. These involve exchanges among people who are acquainted with each other. Network markets have no predefined geographic characteristics, but routine activity markets have obvious spatial relationships. Routine activity markets can illustrate the contradiction between computer generated hot spots and real hot spots. The crime pattern of this type of markets is governed by street patterns, traffic volume, and other factors. The presentation will show how the actual hot spot (as shown in ArcView GIS) can violate the theory that crime patterns follow street patterns.

It is possible to incorporate the theory into clustering algorithms. ArcView allows a "geographically weighted" approach and more tightly drawn estimation of the recorded events. This

better supports crime theory and hot spot detection by (1) allowing quicker detection of potential hot spots, (2) reducing the area within the predicted hot spot where crime is unlikely, and (3) showing a more meaningful orientation of the predicted hot spot. The handout to attendees will show how they can apply geographical weights in commonly used spatial analysis programs.

Practical Consequences of the Gap Between Crime Pattern Theories and Methods, **Howard A. Stafford and James Frank.** There is a long history of police interest in the analysis of crime data to detect hidden patterns. O.W. Wilson, in his *Police Administration*, was one of the first to advocate the use of pin-maps to identify where patrol cars should be deployed. The idea was straightforward. Offenders follow patterns and if these patterns can be discovered quickly, it is possible to put patrol officers in locations where they can detect crimes in progress or deter offenders. In the 1970s and early 1980s, police experimented with directed patrolling based on flexible deployment of officers depending crime patterns. The COMPSTAT process is but the latest incarnation of this tradition.

Efforts have been made to "go beyond pin maps" and use various clustering algorithms to identify crime patterns and hot spots. These spatial analysis techniques draw on procedures and theories developed in other disciplines (e.g., psychology, geography, human ecology) and which have been adapted for use on crime data. Routine Activity Theory, Situational Crime Prevention, and Offender Search Theory are examples. However, crime pattern detection techniques do not make sufficient use of the insights in these theories. This has practical consequences. First, because the environment of crime is not examined, it takes longer to detect developing crime patterns. Second, the shape of projected crime patterns is too highly sensitive to outliers, and the techniques used may enclose spaces where crimes are unlikely while overlooking spaces where crimes are likely. Finally, the theoretical and practical validity of hot spot delimitation can be questioned.

This presentation enumerates the varying assumptions made by commonly used crime hot spot detection techniques and discusses the practical consequences of violations of these assumptions.

Using Target Patterns to Identify Crime Patterns, **Xinhao Wang and Lawrence Travis**. Normally a crime analyst maps the spatial distribution of criminal incidences and tries to identify some form of spatial patterns that can help to decide where the target spots or areas are. However, from past experience and theories presented earlier, criminal incidences do not happen independently from the pattern of potential crime targets and other environmental characteristics that structure crime opportunities. For example, a pattern of gas station robberies is partially determined by the locations of gas stations.

This presentation will be based on data from Hamilton County, Ohio (the county surrounding and including Cincinnati). Specifically, the presentation identifies target places where crimes are likely to happen, such as gas stations, grocery stores, or convenience stores; maps their distribution; and generates "hot spot" maps of these potential targets. The spatial distribution of different types of criminal incidences considered to be associated with these targets is examined, and hot spot maps for these crimes are generated.

The target hot spots and crime hot spots are compared to determine how they overlap. Systematic "mistakes" can be expected. This comparison will provide information about possible errors made by crime hot spot prediction techniques: Type I Errors (false positives) use the predicted crime hot spots that include areas where there are no targets, and Type II Errors (false negatives) are predicted crime hot spots that exclude nearby target areas.

Finally, the presentation will conclude with a discussion of how crime analysts and researchers can include environmental background characteristics in their predictions of crime hot spots. This should make the use of crime mapping more proactive, rather than reactive. A handout showing attendees how to apply the material presented in this presentation will be distributed.

Mapping Around the World

***Spatial Perspective of Murder in London, 1997-1999,* Mark Patrick.** While London does not suffer the murder rates of many world cities, there is an increasing trend in this area fuelled by the activities of Jamaican and homegrown drug gangs. A number of initiatives have been put in place to tackle the increase, with crime analysis informing the proactive tactical effort. Drawing on three strategic reports on the nature of murder in London, this presentation focuses on spatial aspects of this work. Using some 450 murders over a three-year period, the presentation details the use of spatial statistics and hotspot surfaces to help understand the distribution of murders of different types.

If there is a category of murder that is most random in its distribution, it is domestic murder. The paper will further present findings on the composition and distribution of this category of homicide.

***Cross-border Mapping: How to Participate from the Knowledge of Other Agencies — Basic Considerations and Examples,* Heiko Schneider and Heiko Held.** Following current efforts in the U.S. and abroad, this presentation deals with the German experience of the role of crime mapping in the context of cross-border-acting offenders and the necessity of connecting different databases. This analysis includes both law enforcement and external data demonstrations.

The German Police Force (because of its federal structure) can look back on a long phase of data collection and connectivity (since 1972). Experiences, for instance, in fighting against travelling offenders, carrying out controlled deliveries, and leading investigations in conjunction with other national police forces, Interpol, and Europol will describe and emphasize the possibilities and opportunities related to crime mapping.

The development of the world as a *global village* is of special concern for the police. Borders and border controls are diminishing. Air traffic and rapid means of trade create a single world market and a common living environment. In particular, satellite television, telecommunications, and the Internet represent the information age. Not only organized crime (OC), but crime in general has adapted rapidly to this new environment. Criminals take advantage of the almost borderless opportunities, using intercontinental transport and telecommunications. Internationalization and cross-border activities within the U.S. strengthen criminal activities and enhance criminal profits.

In former times, criminal groups operated mostly at a local or regional level. Now however, illegal goods such as drugs, arms, and counterfeit money can be sent around the world to other markets in just a few days. Defrauders can reach millions of victims via the Internet, and profits can be laundered with electronic banking within a day by distributing money to many different banks, companies, and financial institutions. These movements require better exchange and analysis of information from different sources, with selected methods and tools. In this context, crime mapping can successfully contribute to the fight against crime.

In particular, development of the new police information system ("Inpol new") will involve new crime analysis possibilities at the local level and beyond. Soon, the German Police will, for example, be able to identify actual development of crime all over the country (and identify regional hot spots). It will be better able to recognise and pursue serial offenders. Police management, wherever they are located, will be informed about the actual crime situation, so they can act in a quicker and more targeted way. Crime mapping is a most important instrument in that context.

Crime Patterns in Non-Urban Settings

***Using ArcView GIS to Explain Non-Metropolitan Crime: Test of Social Disorganization Theory on Crime in a Non-Urban Community,* Jay T. Gilliam.** While considerable attention has been given to urban crime within criminology, rural and non-metropolitan crime bas not been as thoroughly researched. The criminal behavior that occurs in smaller communities, while being greatly underrepresented within the academic literature, offers a unique and fertile area for

both empirical and theoretical development. This paper begins by examining what characteristics make rural and non-metropolitan communities unique from urban areas. The presenters contend that academic researchers and policy makers are both in error when they take any research discoveries using urban data and apply these findings to non-urban areas. While applying the data may seem logical, non-urban communities are both distinct and divergent from urban areas, requiring separate yet equal attention. This construct gave a framework for testing social disorganization. Researchers have incorporated data with concepts from ArcView GIS technology to construct neighborhood boundaries and census block group information, to provide the data for each of these neighborhoods. This allows the study to analyze crime from the neighborhood in ways that would not otherwise be possible. ArcView also assists the theoretical test for social disorganization. First, we use census data to construct scales of neighborhood ethnic heterogenity, neighborhood poverty, residential instability, and female-headed households. These scales are statistically tested with the property crimes found in each neighborhood. While this research is preliminary due to certain data constraints, it offers a unique analysis of non-metropolitan crime by applying a theory and methods that (until recently) were reserved for the study of urban crime.

Assessing Spatial Patterns of Crime in Smaller Communities, **Alan T. Murray and William V. Ackerman.** Police departments, city officials, and policy makers all recognize the importance of better understanding the dynamics of crime. Both theoretical and applied approaches that provide insight into why and where crime takes place are much in demand. Geographic information systems and spatial analysis techniques are proving to be essential for studying criminal activity. This paper explores the use of geographic information systems and spatial analysis for examining crime occurrence in Lima, Ohio, a city of approximately 50,000 people. The presentation will highlight novel capabilities for investigating patterns of crime.

Predictive Modeling: Findings from Five Studies: Part II

Spatial-Temporal Point Process Models for Criminal Event Prediction, **Donald E. Brown and Steven H. Kerchner.** An important need in crime prevention is to predict the likelihood that criminal incidents occur at specified locations within a geographic region and a specified time range, based on historical incident records. A model for predicting the probability of occurrence of spatial-temporal random events was developed based on the theory of point patterns. This model views the available data as a realization of a marked space-time shock point process, and the prediction problem as the estimation of the space-time transition density of the process. In contrast to traditional space-time prediction models, this model incorporates richly informative observed event characteristics or features into space-time prediction. Our previous model assumes temporally homogeneous data and thus excludes all temporal features. This extension to the model incorporates temporal feature heterogeneity by changing the temporal transition density calculation. Test results comparing this model with traditional methods for predicting hot spots show that the model with temporal features outperforms other approaches in some cases, but that use of temporal features is only effective in data sets that display temporal patterns.

Predictive Modeling of Space/Time Crime Patterns: Comparative Analysis of Random Walk, Univariate, and Leading Indicator-Based Multivariate Models, **Andreas M. Olligschlaeger.** This talk discusses the results and implications of a two-year study comparing the forecast accuracy of a number of predictive modeling techniques for space/time patterns of three types of crime: violent crimes, property crimes, and drug hot spots. Specifically, those methods include random walk and naïve monthly comparisons of crime, univariate smoothing methods (with and without

trend and seasonality), and multivariate leading indicator-based regression and chaotic cellular forecasting methods.

All methods were tested using seven years of point-based GIS data obtained from the of Pittsburgh 911 and records management systems. The multivariate techniques were implemented as they would have been in a daily operational environment, thus providing a more realistic indicator of their usefulness to crime analysis.